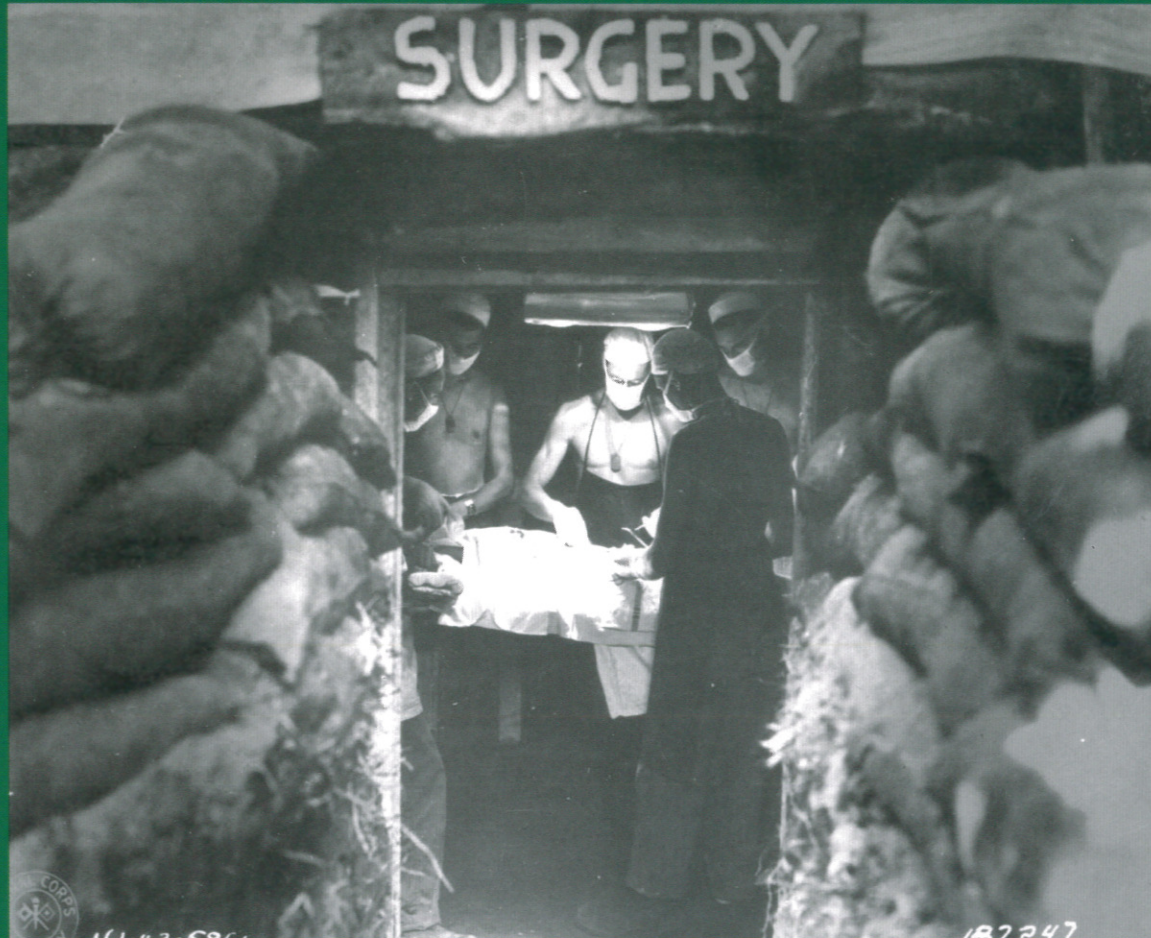


BATTLEFIELD SURGERY 101: FROM THE CIVIL WAR TO VIETNAM



Essays on Military Medicine and Surgery

and

Selected Photographs From the Exhibit

Catalogue in Support of the Exhibit at the National Museum of Health and Medicine, Washington, DC.

Front Cover. Pvt. Connell is prepared for surgery. The anesthetic is administered and the surgeons begin the work that eventually saves his life. 1943. SC 187247

BATTLEFIELD SURGERY 101: From the Civil War to Vietnam

Part 1

Patient Flow in a Theater of Operations

Dave Ed. Lounsbury, MD, FACP

Colonel, Medical Corps, US Army

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Part 2

Twentieth Century Warfare and the Evolution of American Battlefield Surgery

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Part 3

Selected Photographs From

BATTLEFIELD SURGERY 101: From the Civil War to Vietnam

Based on the Exhibit by J. T. H. Connor, Michael G. Rhode, and J. Carey Crane



This catalogue was prepared by the Borden Institute (Office of The Surgeon General, US Army) in support of the exhibit
BATTLEFIELD SURGERY 101: FROM THE CIVIL WAR TO VIETNAM
at the National Museum of Health and Medicine of the Armed Forces Institute of Pathology

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PREFACE

In September 1862, Union forces numbering 75,316 troops assaulted a Confederate force at Antietam, Maryland. When the battle ended, 2,108 Union soldiers had been killed outright. Another 9,549 lay wounded. Of these wounded, approximately 1,300 (14%) soon died of their wounds.

Almost a century later, on 6 June 1944, some 90,000 Allied soldiers stormed ashore on the beaches of Normandy, France. On that day, 2,000 were killed. The wounded numbered over 7,000; of these, approximately 200 (3%) subsequently died of their wounds.

To be sure, military medicine has made great strides since the preantibiotic, preantiseptic, and crude surgery days of the mid 19th century. These strides both mirrored civilian advances in medicine and reflected expertise honed behind the battlefields. Advances in trauma surgery, critical care, anesthesiology, infectious disease management, burn care, and medical evacuation continue, such that any American soldier who arrives alive at a military field hospital now is almost certain to survive.

The National Museum of Health and Medicine in collaboration with the Borden Institute of the Office of the Surgeon General, US Army, presents in *Battlefield Surgery 101* images of this understated progress. However, for the most part, the photographs are not intended to portray a linear theme of steady progress in any one area of specialty. The selected scenes are intentionally disparate. But we

think each one captures a distinct motif or vignette that the power of photography introduced to military medicine. This catalogue extends that lesson.

We think it is important, too, to reflect on what this photographic exhibit does *not* teach. After 20 years of careful analysis, Ronald F. Bellamy, MD, Colonel (Retired), more than any other military surgeon or spokesman, teaches us that

- Wounds to the head and chest, be they made by gunshot or spear, have the same terrible lethality today as in ancient times.
- Protective armor and equipment have done more to save lives on the battlefield than surgery.
- A soldier's recovery from wounds ultimately depends on rapid intervention in the first minutes after injury.
- And the critical interventions that preserve a life are more often *not* performed in the operating room by a surgeon but on the battlefield by a medic.

Battlefield Surgery 101: From the Civil War to Vietnam is released in conjunction with the National Museum of Health and Medicine's exhibition of the same title. There, images, artifacts, and motion picture footage amplify the messages of this text. The objects speak, poignantly, to the lives lost and the lessons learned on the fields of combat. Sadly, this grim record of medicine in war has not diminished mankind's inclination to resort to armed conflict in order to achieve his aims. In the end, as Bellamy reminds us, "battlefield surgery does not make war safe."

Adrianne Noë, PhD
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PATIENT FLOW IN A THEATER OF OPERATIONS

by

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Colonel, Medical Corps, US Army

One of the distinguishing characteristics separating wartime military medicine from civilian practice is the concept of staged medical care: as the wounded soldier is evacuated away from the battlefield, different people in widely different places take part in his or her resuscitation, treatment, and recovery (**Figure 1-1**).

Throughout the 20th century, this process was regimented and corresponded to troop deployments in the theater of operations. It provided a continuum of care from the forward line of troops all the way back to military and Veterans Administration hospitals in the United States.

Following is an example of this care as it might have been provided in World War I, World War II, the Korean War, and the Vietnam War. In the course of battle, a soldier has sustained a serious wound to his leg. Massive bleeding from the open wound is occurring. It is apparent early on that it is not likely the limb can be saved.

At the site of wounding, a call goes out for a medic (**Figure 1-2**). A trained corpsman races to the wounded soldier's side. Simultaneously, the medic surveys the patient for other injuries and applies pressure bandages to the wound. Controlling blood loss at this point is his major

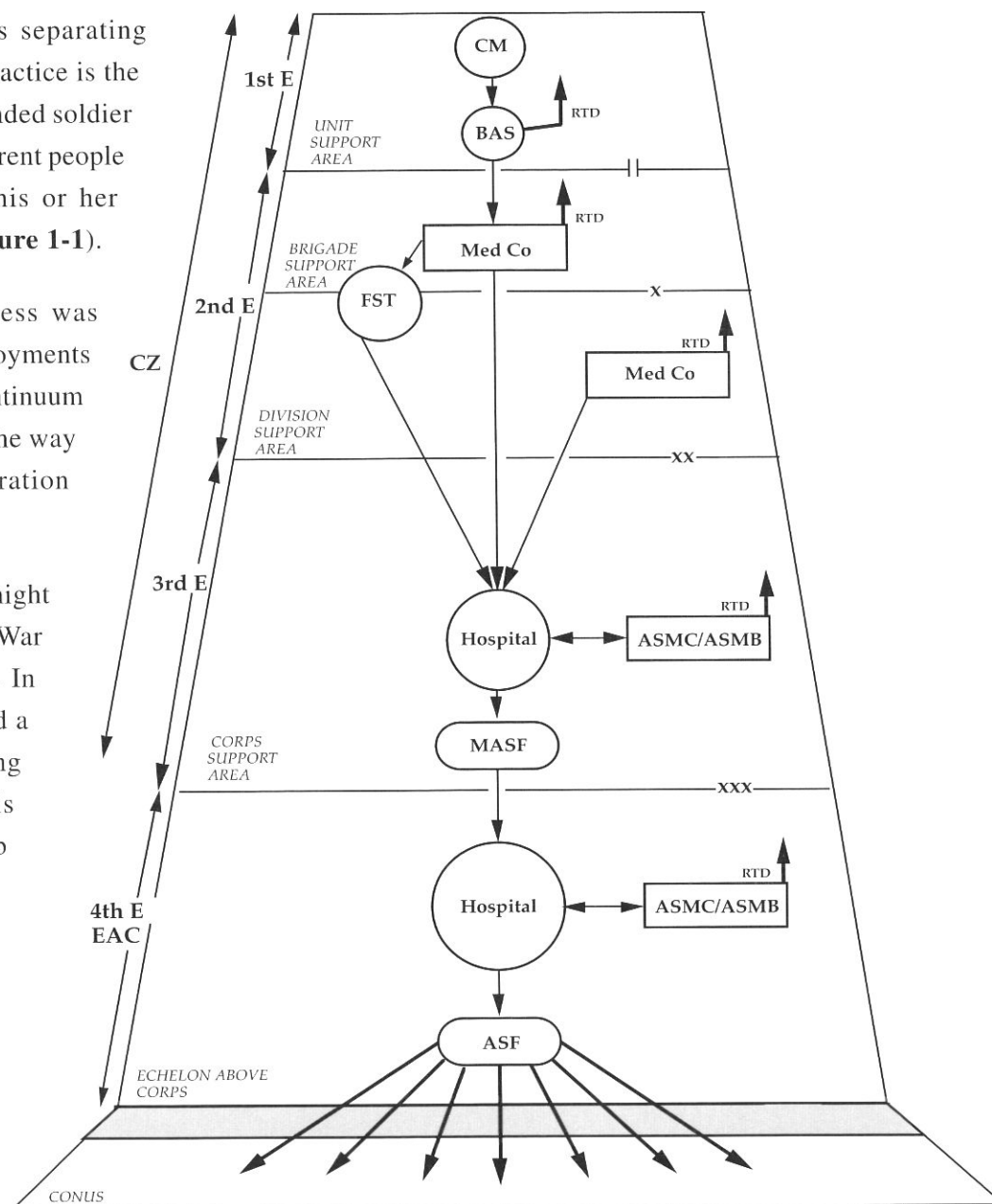


Figure 1-1. Adapted from Zajтчuk R, Bellamy RF, eds. *Textbook of Military Medicine*. Washington, DC: Department of the Army, Office of The Surgeon General, Borden Institute; 1991–1997: xv.



Figure 1-2. First aid by company aid man. Yank medics treat the leg wounds of a wounded GI near Metz, France, September 8, 1944. SC 193775.



Figure 1-3. Sgt. Silford S. Dixon (Edgewater, Florida) sweeps in front of the tent of the first aid station at 160th Infantry Regiment, 40th Division. Cape Gloucester, New Britain. May 24, 1944. SC 264544.

consideration and can be lifesaving. A tourniquet, though often not required, may be applied above the bleeding. Morphine is administered, and an intravenous (IV) line may be placed for vigorous fluid replacement to restore fluid loss (hypovolemia) and prevent shock.

The patient is carried by stretcher to a nearby battalion aid station (BAS) (**Figure 1-3**). This may be a single tent, a specially adapted vehicle, or simply an improvised shelter. The BAS is staffed by medics and a physician's assistant or a general medical officer; further stabilization of the



Figure 1-4. Lt. Col. van Buskirk, 8076th Army Surgical Hospital, Kunu-Ri, Korea. SC 345715.

patient occurs here. One or two IVs are started. The leg is splinted and the wound dressed. Prompt evacuation is arranged, as the BAS is not intended to hold patients. Medical evacuation is provided by ambulance (World War I, World War II, Korean War) or helicopter (Korean War,

Vietnam War). The patient is taken to the nearest hospital rearward. This often would be a mobile army surgical hospital (MASH) (**Figure 1-4**). Never as “mobile” as intended, these were forward hospitals equipped with 2 operating room (OR) tables and about 60 beds.



Figure 1-5. In Vietnam, triage and preop were sometimes in the same location. Swan Collection 246b.

At the MASH, incoming casualties are triaged, that is to say, they are prioritized by a surgeon so as to provide the most and fastest care to the most individuals, often with limited resources and in an austere environment. Some

patients arriving at the same time as our patient have been found to be stable enough to await *delayed* intervention. On occasion, the triage surgeon may conclude that a patient with massive injuries cannot be saved under given

circumstances, either due to the press of more salvageable cases or because death would result even under optimal hospital conditions. These patients are called *expectant* and are provided comfort-oriented care. Our patient is triaged for

immediate surgery and sent to the preoperative ward (**Figure 1-5**). All the while, he is undergoing further stabilization: blood and other fluids are taken for laboratory tests, a catheter is placed in the bladder, the leg is splinted, antibiotics are started.



Figure 1-6. A captured North Korean soldier undergoes an emergency operation in an American base hospital. Pictured left to right: 1st Lt. Mary Keefe, Capt. Cecilia Kirschling, Capt. Purdue Gould, Capt. Charles D. Dasterday, 1st Lt. James Seacrest. SC 345836.



Figure 1-7. [An] Army Nurse ... feeds liquid food to Sgt. Buckalew via a nasal tube, due to mouth and throat injuries received on the front line in Korea. 12th Evacuation Hospital, Yongfong-Po, Korea. SC 349961.

In the OR (**Figure 1-6**), the wound is exposed. The tourniquet, if present, is removed. Hemostasis is obtained. Contamination and destroyed or visibly contaminated tissue are removed by aggressive debridement. Repair of a blood vessel (during and since the Korean War) may be performed. Fractured legs are rigidly fixated with external frames (fixators). Wounds are cleaned but invariably left open (not sutured closed) to help prevent subsequent infection. Our patient's limb is too severely damaged to be saved. Amputation is performed above the wound. The stump is left open and wrapped in heavy bandages.

The patient is collected with others and removed to a large hospital further in the rear. This is usually a combat support hospital or a field hospital (**Figure 1-7**). The latter is a large facility of 300 or more beds with several ORs, subspecialty surgeons and physicians, a radiology department, and a laboratory. Our patient's wound is reexamined. He is taken back to the OR for more debridement and a surgical revision of the amputation. The stump is revised to provide optimal length and shape for the best fit for a weight-bearing prosthesis. Surgical revision may require reamputation or disarticulation (joint separation). Multiple operations are often necessary before the wound is healed.

Finally, the patient is evacuated further rearward to a fixed facility overseas (eg, the military hospitals in Japan and Germany) and then on to a military medical center nearest his home in the United States (**Figure 1-8**). There, rehabilitation and physical therapy are provided (**Figure 1-9**). A program to strengthen muscles in the remaining leg is



Figure 1-8. [Wounded transferred from ambulance to hospital plane.]
NCP 4143.

prescribed. A series of temporary prostheses is provided for 6 months or longer, when a permanent prosthetic is provided. Long-term rehabilitation is often completed closer to home at a Veterans Administration rehabilitation facility.

(This scenario of treatment and recovery is considerably different, of course, in the case of penetrating injuries of the head, chest, and abdomen. Recovery from these latter wounds is typically much more prompt.)

In recent conflicts such as those in Afghanistan and in both Persian Gulf Wars, the above scenario was markedly abbreviated. Acutely injured soldiers, then and now, are often evacuated directly from the site of wounding by medical evacuation helicopters. The mobile medical facilities may be bypassed as injured soldiers are taken directly to well-equipped and subspecialty-staffed combat support and field hospitals. Often that same day, and invariably within 72 hours, casualties are transported to the American Regional Medical Center at Landstuhl, Germany, and from there to the United States, where Walter Reed Army Medical Center is the largest receiving hospital.



Figure 1-9. PFC Tristan Wyatt (43rd CE, 2/3 ACR), wounded in Iraq in 2003, here engaged in physical therapy at Walter Reed Army Medical Center, Washington, DC.

TWENTIETH CENTURY WARFARE
and
THE EVOLUTION OF AMERICAN BATTLEFIELD SURGERY

by
Ronald F. Bellamy, MD, FACS
Colonel, US Army, Retired

I would say that two contrary laws seem to be wrestling with each other nowadays: the one, a law of blood and death, ever imagining new means of destruction and forcing nations to be constantly ready for the battlefield—the other a law of peace, work, and health ever evolving new means of delivering man from the scourges which beset him. Which of these two laws will ultimately prevail God alone knows.

—Louis Pasteur

Comment contained in a speech opening the Pasteur Institute, Paris, France, 14 Nov 1888. Dubos RJ, trans. Quoted by: Dubos RJ. *Pasteur and Modern Science*. Garden City, NY: Anchor Books; 1968.

INTRODUCTION

To appreciate the evolution of American battlefield surgery, we first need to consider what makes military surgery distinctive and also how it differs from civilian surgery. Of course, in a real sense, civilian surgery developed from battlefield surgery. Even Hippocrates, the ancient Greek physician and the father of medicine, wrote, “...he who would become a surgeon, therefore should join an army and follow it.”¹ But during the second half of the 20th century, civilian surgery, including the surgery for victims of trauma, grew away from battlefield surgery, which was seen by some as a “crude departure from accepted surgical standards.”² However, as we will show, this kind of criticism represents a failure to understand the unique nature of battlefield surgery.

Many aspects of battlefield surgery are not considered here (such as anesthesia and preoperative and postoperative care, including life-saving first aid on the battlefield, blood banking, and rehabilitation). In addition, most military surgical procedures are not performed in mobile surgical facilities—the kind of hospital featured here—but in large, stationary hospitals. By focusing on the evolution of battlefield surgery from World War I to the present, we do not mean to belittle the achievements of American military surgeons prior to World War I. During the American Civil War, General Jonathan Letterman and others developed a formal organization for the collection and evacuation of casualties, and this stands as one of the sentinel achievements in all of military medicine. However, when viewed by our 21st-century standards, surgery in earlier wars was so primitive that few therapeutic lessons (beyond stopping hemorrhage and controlling infection) are still applicable.

The best way to understand modern battlefield surgery is to consider some cardinal aspects of its evolution, and to ask the following questions:

- What is unique about battlefield surgery, and how does it differ from civilian surgery?
- How is battlefield surgical care organized?
- How has the length of time been reduced between wounding and surgical care?
- What kinds of wounds do battlefield surgeons treat?
- How has the evolution of battlefield surgery affected mortality (rapid death) and morbidity (lingering effects of a condition)?

¹ Garrison FH. *Notes on the History of Military Medicine*. Washington, DC: Association of Military Surgeons; 1922: 18.

² Whelan TJ Jr. Prologue. In: Bowen TE, Bellamy RF, eds. *Emergency War Surgery NATO Handbook*. 2nd rev US ed. Washington, DC: Department of Defense, Government Printing Office; 1988: ix.

WHAT IS UNIQUE ABOUT BATTLEFIELD SURGERY?

First and foremost, battlefield surgery is a *system* of treating and transporting casualties. It differs from civilian surgery in a number of unique, integrated ways³:

- Battlefield surgery can take place during mass casualty situations and in an austere, dangerous, and resource-limited environment.
- Battlefield surgeons do what *must* be done for the casualty rather than what *could* be done before either returning the casualty to his unit or rendering him transportable to the next higher echelon (level) of medical care.
- The battlefield surgical care system depends on an organized prehospital treatment and medical evacuation system.
- The system depends on providing care by level—the levels are capable of providing surgical care of increasing sophistication—but each level has the same goal: it either returns the casualty to duty (to his unit) or evacuates him safely to the next higher level of care.
- There is effective first aid at every level—especially at the site of wounding—and a rapid and responsive medical evacuation system connects all levels.
- Wartime injuries are generally caused by penetrating and blast sources, whereas most civilian injuries are caused by blunt sources. Of course, most individual casualties do not simultaneously display all aspects of wartime injuries. Battlefield surgeons, however, see enough different wounds to be all too aware of their gruesome nature.

HOW IS BATTLEFIELD SURGICAL CARE ORGANIZED?

The organization of the battlefield surgical system can be understood by studying the following schematic drawings (several of which are from official Army histories). The diagrams are at best simple approximations of what transpired, but they all show the complicated interaction between levels of care, the location of surgical treatment facilities, and the paramount importance of an evacuation system. For comparison, a diagram of a typical civilian trauma care system is also included.

World War I

The system used by the US Army in late summer 1918 used compressed levels of care in close proximity to the German lines (**Figure 2-1**). This arrangement can be explained by the positional nature of the warfare; the lack of effective, long-distance weapon systems such as a tactical air force; and the simultaneous lack of operational means of breaking through the enemy's defensive position. In other words, there was no way of attacking installations such as hospitals located behind the front lines.

World War II

The US Army in Europe circa 1944 used the system shown in **Figure 2-2**. Primarily because of the advent of armored forces and tactical air forces, the levels of care were now much more dispersed. Not only must surgical care be provided to the armored

³ Bowen TE. General considerations of forward surgery. In: Bowen TE, Bellamy RF, eds. *Emergency War Surgery NATO Handbook*. 2nd rev US ed. Washington, DC: Department of Defense, Government Printing Office; 1988: 1–9.

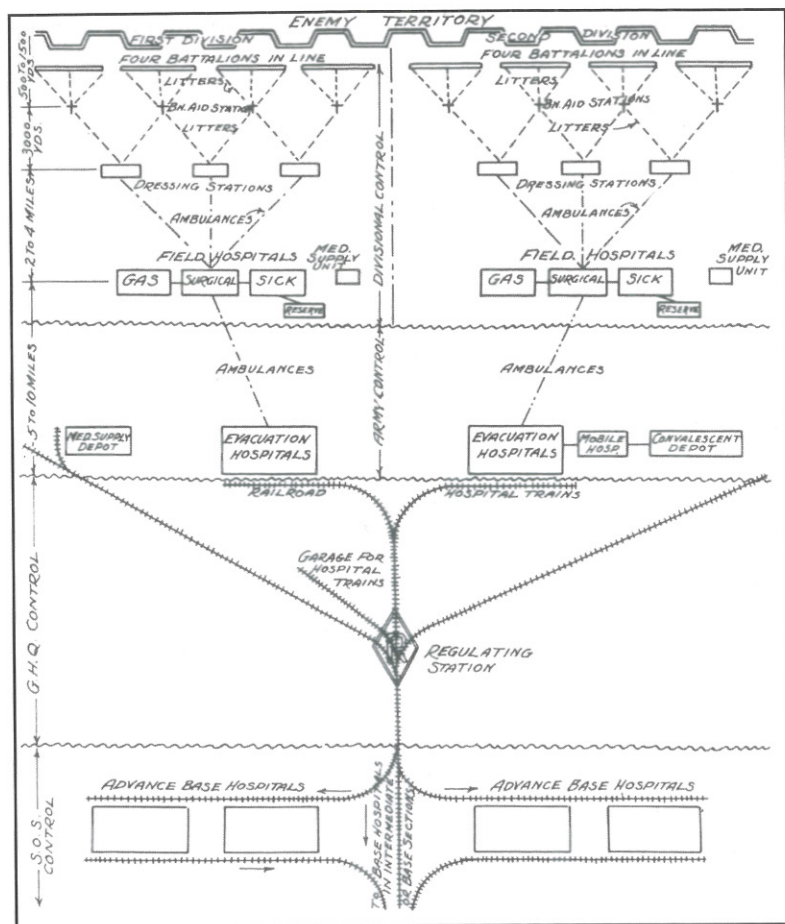


Figure 2-1. Schematic diagram of hospitalization and evacuation system, Army Expeditionary Force. Reprinted from Lynch C, Ford JH, Weed FW, eds. *Field Operations*. Vol 8. In: Ireland MW, ed. *Medical Department of the United States Army in the World War*. Washington, DC: US Department of the Army, Medical Department, Office of the Surgeon General, Government Printing Office, 1925: 262.

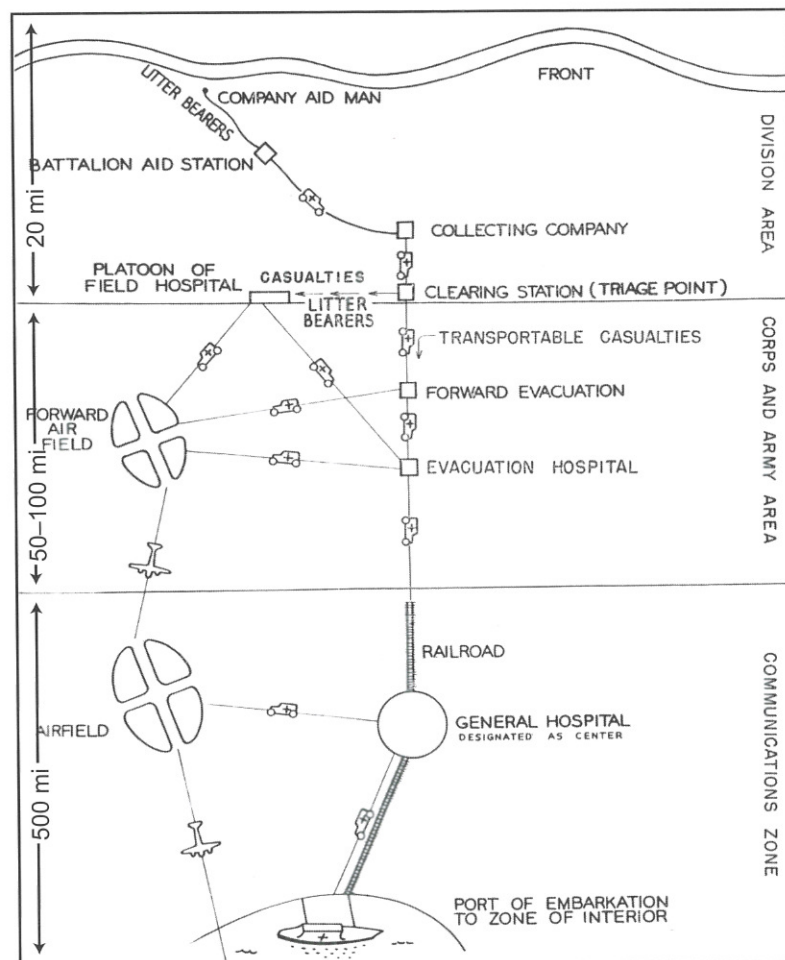


Figure 2-2. Adapted from Berry FB, ed. *Thoracic Surgery*. Vol 1. In: Coates JB Jr, ed. *Surgery in World War II*. Washington, DC: US Department of the Army, Medical Department, Office of The Surgeon General; 1963: 57.

forces striking through the enemy lines, but large concentrations of hospitals near the frontlines had also become vulnerable.

Vietnam War

The system used by the US Army in the Vietnam War was very different from the system used during the world wars (**Figure 2-3**). Note in the diagram that there is really no defined boundary between the opposing forces, as the Army occupied what were in essence cantonment areas. Because of absolute aerial supremacy, US casualties could be and usually were evacuated by air directly from the site of wounding to a surgical hospital.

The Persian Gulf Wars

Figure 2-4 shows the US Army Medical Department's organizational doctrine at the beginning of the 21st century. The conditions existing at the start of the Second Persian Gulf War required a simplified organization, which is shown on the diagram by heavy black lines. Note the extreme separation of the medical levels—perhaps by as much as 50 to 100 miles. This reflects a war of maneuver so unlike what existed during the Vietnam War.

Civilian Trauma Care System

Figure 2-5 shows the civilian trauma care system typical of a large urban area. Note that in comparison with the schematic drawings of the four wartime military organizational systems, all the levels of care found in the military system have been telescoped into one hospital.

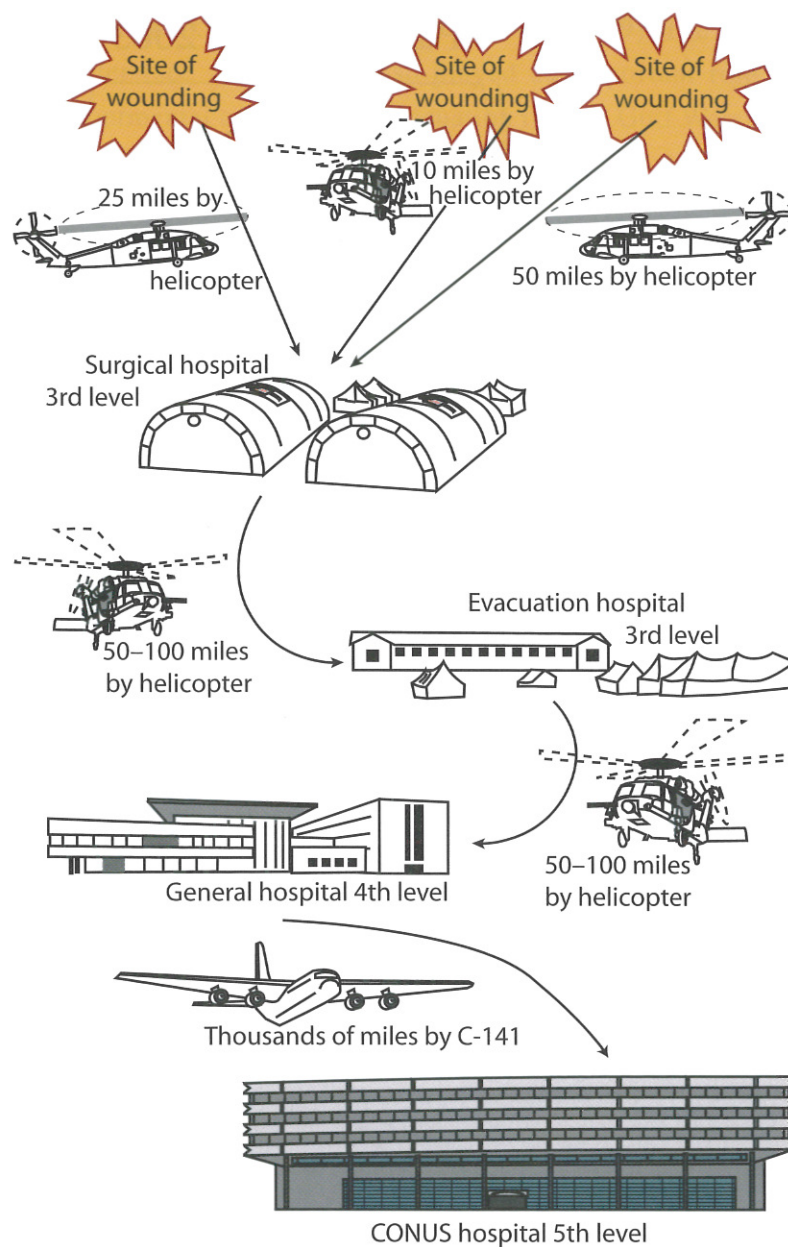


Figure 2-3.

Patient Flow 2003

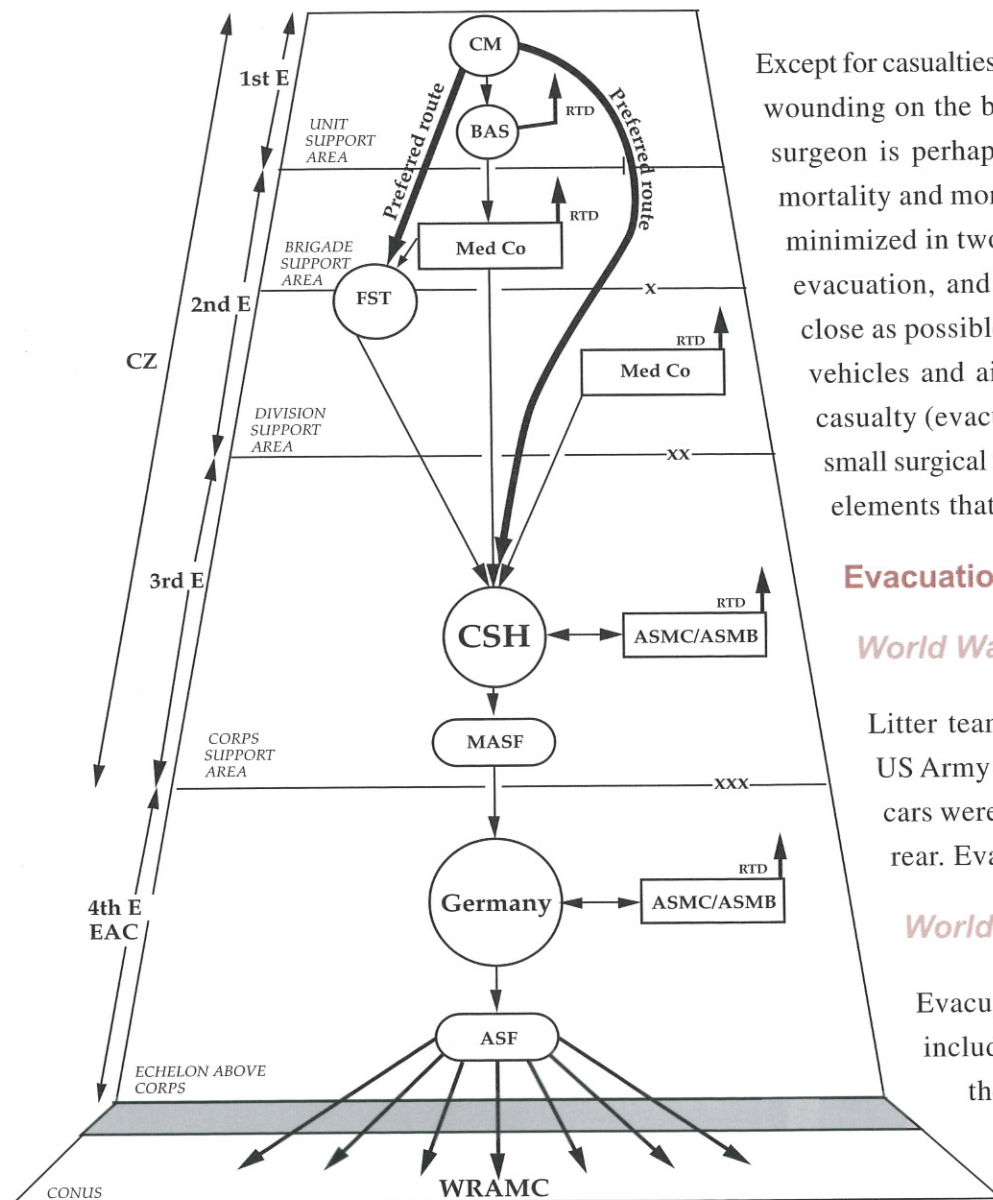


Figure 2-4. Adapted from Zajchuk R, Bellamy RF, eds. *Textbook of Military Medicine*. Washington, DC: Department of the Army, Office of The Surgeon General, Borden Institute; 1991–1997: xv.

HOW IS THE TIME SHORTENED BETWEEN WOUNDING AND SURGERY?

Except for casualties who are killed outright, the length of time between wounding on the battlefield and the first operation by a battlefield surgeon is perhaps the single most important determinate of the mortality and morbidity of combat injury. This crucial time can be minimized in two ways: first, by decreasing the time required for evacuation, and second, by positioning the surgical hospital as close as possible to the battlefield. The first usually means using vehicles and aircraft rather than using manpower to move the casualty (evacuation). The second has meant the deployment of small surgical facilities that have the same mobility as the combat elements that they are supporting (mobile surgical facilities).

Evacuation

World War I

Litter teams and ambulance trucks were the norm for the US Army in World War I (Figure 2-6). Railway ambulance cars were frequently used to move casualties further to the rear. Evacuation was exclusively by ground.

World War II

Evacuation assets used by the US Army in World War II included litter bearers, the all-terrain jeep, and now, for the first time in warfare, large-scale aeromedical evacuation became common-place (Figure 2-7).

In this example, casualties were evacuated in the military version of the DC-3 passenger aircraft.

Vietnam War

Aeromedical evacuation became the norm in the Vietnam War (**Figure 2-8**). The Huey (UH-1) helicopter was truly ubiquitous. It was said that more than 90% of all US Army casualties were evacuated from the battlefield and between levels of care in this vehicle. After 1966, most intercontinental aeromedical evacuation from Vietnam involved use of the C-141 Starlifter.

The Persian Gulf Wars

The Blackhawk (UH-60) helicopter was used for short-distance aeromedical evacuation in the Gulf Wars. However, because of the great distances between the battlefield and the surgical hospitals in the desert, larger and longer-ranged helicopters such

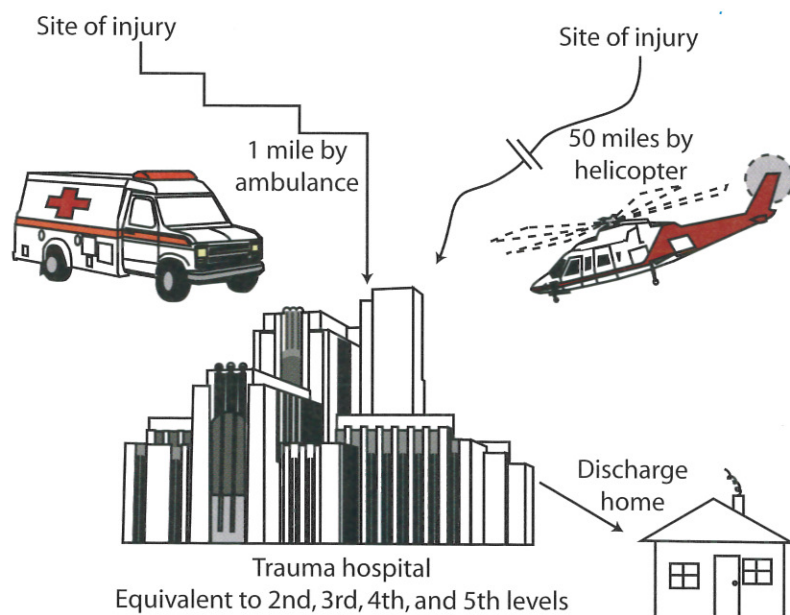


Figure 2-5.

as the Chinook were commonly used (**Figure 2-9**). The C-141 Starlifter (see Figure 2-8) also played an important role in intercontinental aeromedical evacuation in both Gulf Wars.



Figure 2-6. Reprinted from Lynch C, Ford JH, Weed FW, eds. *Field Operations*. Vol 8. In: Ireland MW, ed. *Medical Department of the United States Army in the World War*. Washington, DC: US Department of the Army, Medical Department, Office of the Surgeon General, Government Printing Office, 1925: 228.

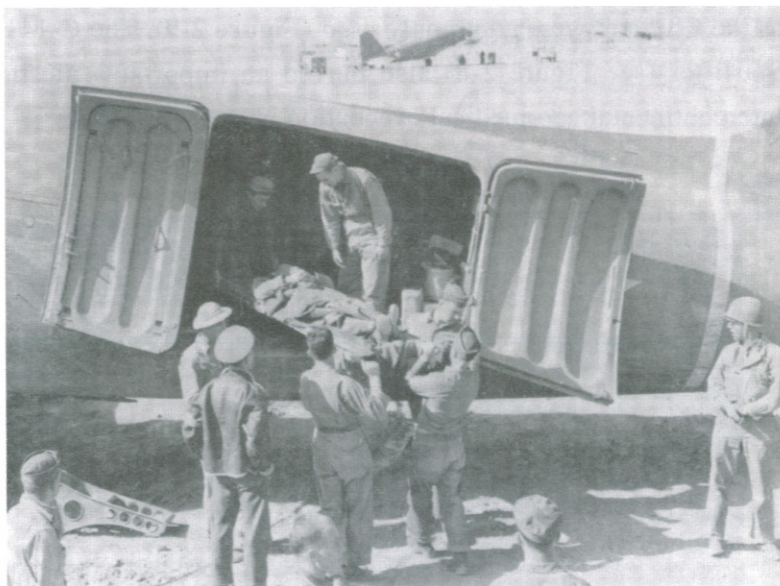


Figure 2-7. Reprinted from Berry FB, ed. *Thoracic Surgery*. Vol 1. In: Coates JB Jr, ed. *Surgery in World War II*. Washington, DC: US Department of the Army, Medical Department, Office of The Surgeon General; 19863: 80.



Figure 2-8. Courtesy of Public Affairs, Office of The Surgeon General, US Army.



Figure 2-9. Courtesy of C. Beading. Uniformed Services University of the Health Sciences, Bethesda, Md.

The availability of long-range aircraft has allowed the Army to downsize the combat zone medical deployment and by so doing, decrease the medical department's traditional logistical burden. Rather than establish large hospital complexes in-country, the Army can now fly casualties directly to large fixed facilities in Europe or the United States.

Mobile Surgical Facilities

World War I

Surprisingly, the need for mobile surgical facilities that could move with the combat units was recognized as far back as 1918 (Figure 2-10). The number of casualties who were treated in these facilities is unknown, but the number was probably in the thousands.

a



b



c

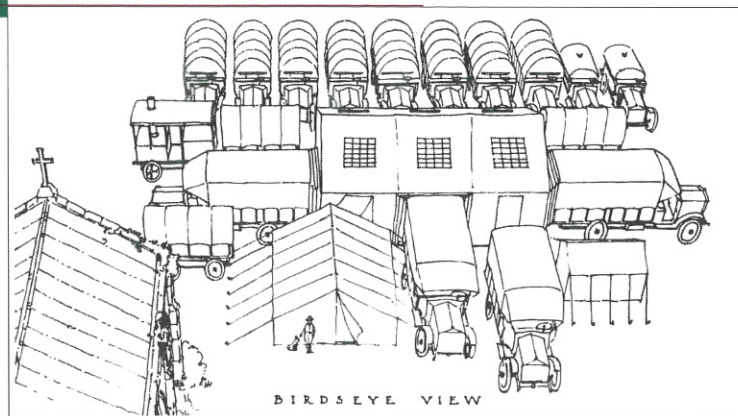


Figure 2-10. Reprinted from Lynch C, Ford JH, Weed FW, eds. *Field Operations*. Vol 8. In: Ireland MW, ed. *Medical Department of the United States Army in the World War*. Washington, DC: US Department of the Army, Medical Department, Office of the Surgeon General, Government Printing Office, 1925: 185.

Figure 2-10a shows part of a mobile hospital moving in the primitive trucks of that era. Figure 2-10b shows the entire hospital deployment in the field. Figure 2-10c shows the setup of the surgical component. As many as 16 operating tables could be set up in the central tent, but what was lacking were corresponding preoperative and postoperative wards of similar capacity. This lack was the Achilles heel of World War I surgical care.

World War II

The need for a US Army mobile surgical facility was recognized during World War II by the middle of 1943 in the Italy campaign (**Figure 2-11**). Their real value, however, appeared following the breakout from Normandy in August 1944. The number of casualties whose initial surgery was performed in mobile surgical facilities is well documented; for instance, 1 of the 5 auxiliary surgery groups is known to have performed over 27,000 operations. Even so, the total number of operations performed by mobile surgical facilities was only about 10% of the total surgical interventions performed.

Figure 2-11a shows a World War II surgical team in jeeps being passed by a tank. Figure 2-11b shows the setup of the World War II version of a mobile surgical facility. Its proper function depended on components of three separate units: first, logistical support by the supported division; second, nurses and enlisted personnel from a designated corps-level field hospital; and third, doctors supplied from an Army- or Army group-level unit called an auxiliary surgery group. Figure 2-11c shows an operation being performed. The austere, dangerous, and resource-limited environment of forward surgical care is clearly demonstrated in these pictures.

a



b



c



Figure 2-11. (a) Reprinted from Brewer LA III, Burford TH. Administrative considerations in the Mediterranean (formerly North African) Theater of Operations. In: Berry FB, ed. *Thoracic Surgery*. Vol 1. In: Coates JB Jr, ed. *Surgery in World War II*. Washington, DC: US Department of the Army, Medical Department, Office of The Surgeon General; 1963: 88. (b and c) Reprinted from Odom CB. Third US Army. In: Carter BN, ed. *Activities of Surgical Consultants*. Vol 1. In: Coates JB Jr. *Surgery in World War II*. Washington, DC: Department of the Army, Medical Department, Office of The Surgeon General; 1962: (b) 305; (c) 309.

The Vietnam War

Because of their success, a formal mobile surgical unit was designed in which the three components (see Figure 11) of the World War II unit were combined. This hospital was first used in the Korean War and was extremely effective in the first year—before the positional

warfare that persisted more or less until the armistice, June 1953. Between then and 1965, the forward surgical facility, now called the MASH (mobile army surgical hospital), became increasingly larger and more sophisticated. MASHs were soon deployed to Vietnam, but because they had little opportunity for maneuver, they rarely lived up to the “mobile” part of their name.

Figure 2-12 is a montage that shows features of a MASH (the 45th) as it was deployed at the Tay Ninh base camp in 1967. The 45th was the prototype for a series of advanced-technology Army hospitals that used “metal boxes” for operating rooms and

wards that inflated like balloons. The almost civilian-like operating room environment is readily apparent. As with many projects that depend on high technology, however, unexpected problems developed and a revision to a more conventional design was necessary before the First Persian Gulf War (1991).

The Persian Gulf Wars

The Vietnam-era MASH had been redesigned to enlarge its patient capacity and to provide even more sophisticated and comprehensive care. There was a corresponding increase in the

size and weight of the entire hospital (to more than 200,000 lb, or 10 times that of the equivalent World War II facility) that soon became distressingly apparent in the First Persian Gulf War—the MASH was much too cumbersome to effectively support armored units as they raced into Kuwaiti and southern Iraq. An ad hoc solution was adopted: forward surgical units were developed that were remarkably similar in concept to the World War II solution. Small but highly mobile Forward Surgical Teams (FSTs) were fielded from bits and pieces of the originals MASHs. These changes led to the design during the 1990s of a formal unit that is being used with considerable success today during the Second Persian Gulf War.



Figure 2-12. Author's personal collection.

Figure 2-13 shows the 274th FST moving in support of the 101st Air Assault division as it moves to Baghdad. The conceptual similarity to the World War I mobile hospital shown in Figure 10a (but not the practical implementation of the concept!) suggests that the more things change, the more they stay the same.

Figure 2-14 shows the hospital tentage.

Figure 2-15 shows FST surgeons operating in an austere but functional operating room. Note the headlamps, a feature that all surgeons would applaud.



Figure 2-13. Courtesy of DE Lounsbury. Borden Institute, Office of The Surgeon General (US Army), Washington, DC.



Figure 2-14. Courtesy of DE Lounsbury. Borden Institute, Office of The Surgeon General (US Army), Washington, DC.

WHAT KINDS OF WOUNDS DO MILITARY SURGEONS TREAT?

The Weapons

The weapon determines the wound. Penetrating missiles (bullets and most importantly, fragments) and, less frequently, blast are the sources of most combat casualties. Although more sophisticated weapons were developed during the past century, they still depend on bullets (fully automatic small arms) and fragments (explosive devices like mines and grenades) for their ability to kill and maim. The high-speed X-ray seen in **Figure 2-16** shows a shell (dotted line) and the fragments it produced as it exploded.

Shaped-charge warheads, which were originally designed to destroy tanks, are explosive devices whose effects are propagated

in a narrow beam. The destructive capabilities of shaped-charge warheads go beyond those of simple explosive devices: they can cause hellacious wounds (**Figure 2-17**). The rocket-propelled grenade (RPG) of past and present notoriety is an example of this type of weapon.

Other fragmentation weapons are buried antipersonnel mines, whose explosive force is directed upward out of the ground, and antipersonnel mines, which are designed to maim. Improvised bombs used by terrorists are also fragmentation devices.



Figure 2-15. Courtesy of DE Lounsbury. Borden Institute, Office of The Surgeon General (US Army), Washington, DC.

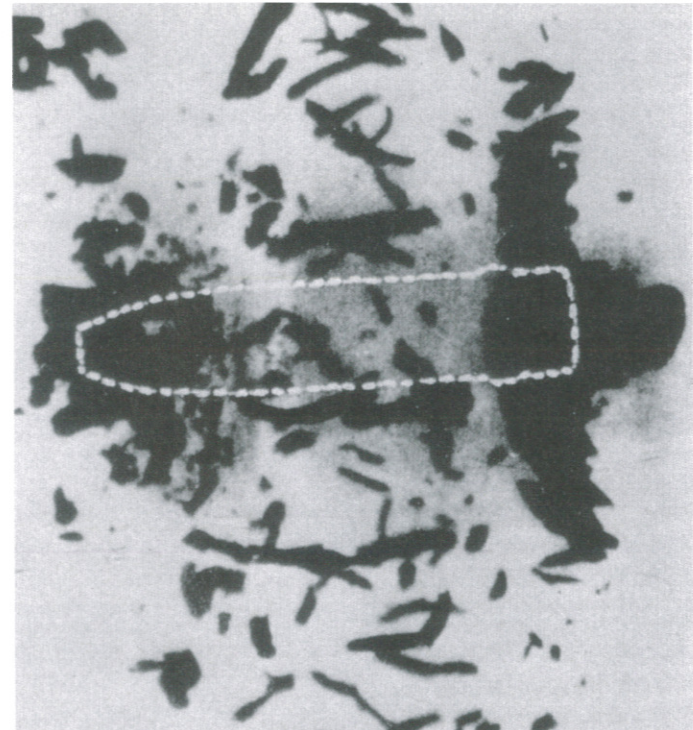


Figure 2-16. Reprinted from Heaton LD, Coates JB, Beher JC, eds. *Wound Ballistics*. Washington DC: Department of the Army, Office of The Surgeon General; 1962.

All these fragmentation weapons can create *multiple wounds*, which may or may not be more lethal than single wounds, but they are disabling for the casualty and time-consuming for the surgeons to treat. Therefore, multiple wounds not only remove the soldier from active duty, they also tie up the medical system. Modern weapons that fire bullets (fully automatic small arms like machine guns and assault rifles) are also designed to create multiple wounds. **Figure 2-18a** shows the exit wounds in a soldier killed in Vietnam by 7 bullets fired by a Kalashnikov assault rifle (**Figure 2-18b**).



Figure 2-17. WDMET database.

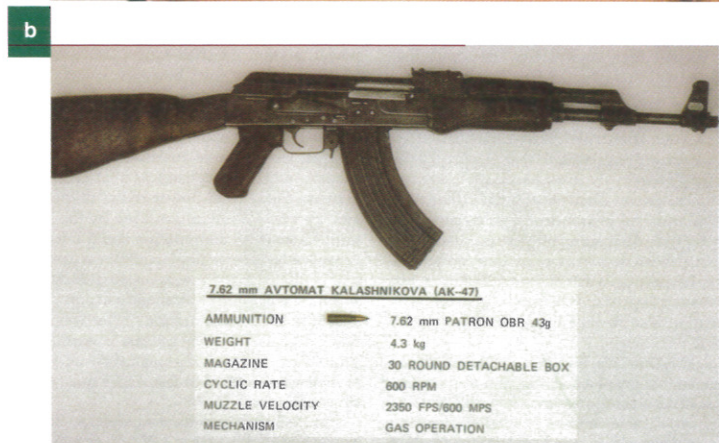


Figure 2-18. (a) WDMET database. (b) Letterman Army Institute of Research, San Francisco, Calif.

One component of any explosive device is its “blast” effect. Until recently, the blast effect has been overshadowed by injuries caused by fragments, but “enhanced” blast weapons have now been created. Battlefield surgeons of the future will likely face casualties who have massive blast injuries manifested principally by damaged lungs (**Figure 2-19**). This casualty suffered a hemorrhage into the alveoli in the upper half of each lung, a finding that is associated with a blast wave and is a characteristic cause of death in blast injuries.

The Wounds

Although the art and science of warfare and its weapons have changed radically during the last 100 years, human anatomy and physiology have not changed at all. Poking a hole several inches deep in the middle of the chest results in the same fatal outcome

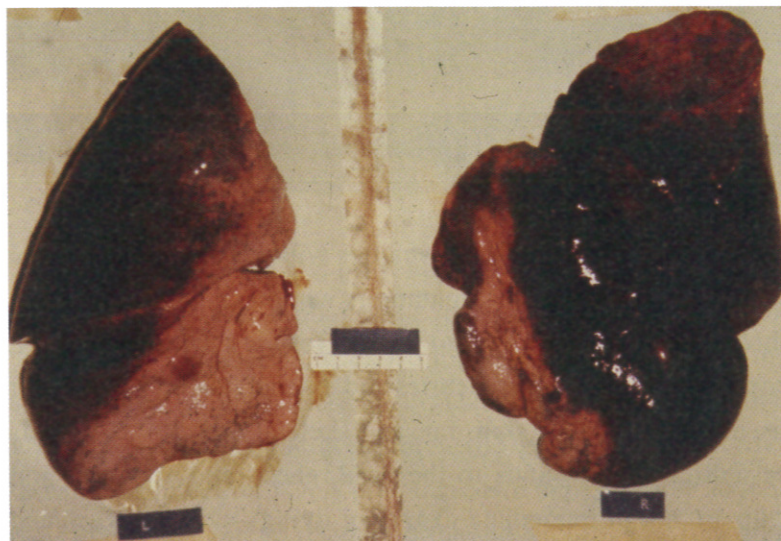


Figure 2-19. Adapted from WDMET database.

today as it would have 100, or even 100,000, years ago. During the American Civil War, surgeons were faced by hemorrhage and infection—just as battlefield surgeons were in the Second Persian Gulf War.

The first thing a surgeon has to do when faced with a group of wounded soldiers is to decide who will be treated first. This sorting of casualties into priority groups is known as *triage*, and has been used since the 19th century. During the Crimean War, one of the founders of modern military surgery, Nicoli Ivanovich Pirgorov, was the first to describe the categories of triage that are still used today (in modern terminology):

1. those requiring *immediate* care to survive,
2. those who can wait a while, even if their wounds are incapacitating, now called *delayed*, and
3. those with minor injuries, who either need no surgical care or can wait a long time, now called *minimal*.

Pirgorov also had a 4th category: those who were beyond help and were put into the care of “the priest.” We now call this last category of triage

4. *expectant*, the casualties who require more medical help than is available and are expected to die.

Those triaged into the first category, *immediate*, are the casualties who are operated on by the surgeons in the forward surgical facilities like the FSTs, while those who can wait for a while (the 2nd triage category, *delayed*) are evacuated to the higher-level (rear-level) evacuation or combat support hospitals. Not surprisingly, the wounds seen by surgeons at the forward and

a



b



c

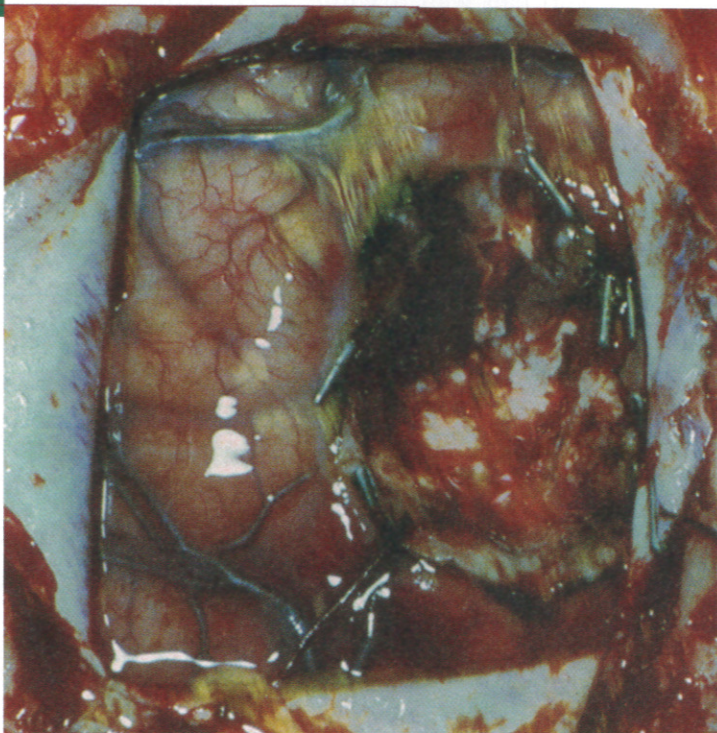
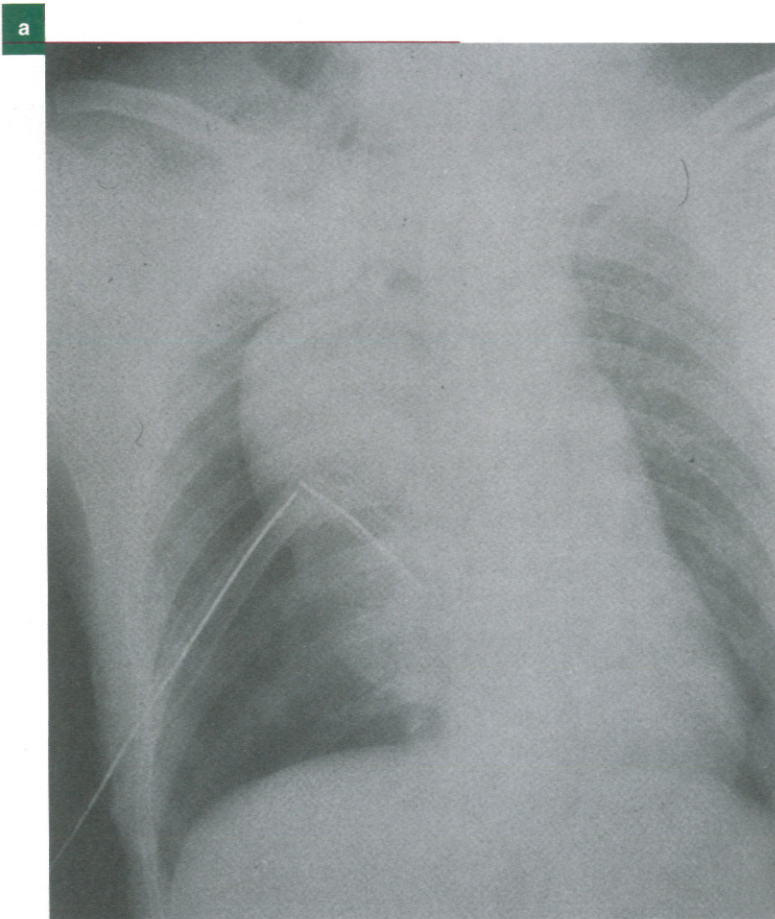


Figure 2-20. WDMET database.

the rear levels will differ: casualties with chest and abdominal wounds and extremity amputations who have potentially life-threatening hemorrhage go to the forward surgeons. Most casualties—those with fractures and extensive injury to the soft tissues of the body (skin, fat, and skeletal muscle) as well as casualties with wounds to the head, chest, and abdomen and who are not in immediate danger of dying—will be evacuated to higher levels of care.



Stopping hemorrhage and preventing infection by cleaning out infection-prone contamination of foreign material such as soil and clothing as well as feces from abdominal wounds are the sine qua nons of all battlefield surgical operations. (Abdominal wounds and bone fractures carry the greatest risk of life-threatening infection.) Only after these two indispensable actions can surgery be done to restore normal physiology and function. These operations are *staged* (performed in sequence), and staging is the best example of how military and civilian surgery differ.



Figure 2-21. WDMET database.

The life-saving arresting of hemorrhage, *resuscitative* surgery, might be performed at an FST. Then the casualty would be evacuated to a higher-level hospital, where *definitive* surgery (which involves prevention of contamination and correction of non-life-threatening injuries) occurs. Finally, the casualty would be evacuated again to an even higher-level hospital where *reconstruction surgery* and rehabilitation would take place. His wounds would be surgically closed and normal function restored. What is unique about this sequence is that hundreds or even thousands of miles may separate the different levels of surgery, and at each level, the casualty is treated by different medical personnel.

The pictures of **Figure 2-20** show the management of a small fragment wound of the head. Figure 2-20a shows the wound of entrance. When magnified, brain can be seen extruding from the hole. The patient was conscious but had unilateral weakness.

Figure 2-20b is an X-ray that shows the fragment deep within the brain. Figure 2-20c shows the appearance of the brain following debridement of damaged tissue. The patient's postoperative course and level of function following his injury were satisfactory.

The pictures of **Figure 2-21** show the results of a bullet wound to the chest that caused serious damage to the lung. Figure 2-21a is an X-ray of the chest showing that the upper part of the lung is filled with blood (the large radiopaque mass on the right). Figure 2-21b shows the bullet hole in the lung exposed during the chest operation. This part of the lung required surgical excision (removal). The patient did well.

The pictures of **Figure 2-22** show the results of a gunshot wound to the flank of the abdomen. Figure 2-22a shows that the patient's intestine has extruded outside the body, a common occurrence. Figure 2-22b shows the damage done to one segment of the intestine by the bullet. All the damaged bowel had to be surgically removed. Because of expert surgery, this potentially fatally wounded soldier survived.

The most common problem faced by battlefield surgeons is wounds to the soft tissues of the extremities, with or without fractures. We have included three representative cases:

The pictures of **Figure 2-23** show an injury and its management: fragment wounds to both legs made by a grenade. Figure 2-23a shows the patient as he appeared following injury by a grenade. Figure 2-23b shows the effect of extensive surgical debridement of these wounds. If the wounds show no signs of infection, they will be surgically closed 4 to 6 days after the original injury.

a



b



Figure 2-22. WDMET database.



Figure 2-23. WDMET database.

bullets. Figure 2-24b shows the X-ray appearance of one of the fractures. Figure 2-24c shows the appearance of both fracture sites after surgical debridement. Figure 2-24d shows the appearance 10 days later of the wounds after surgical closure. The pictures do not show the devices used to hold the bones in the proper anatomical position. It is likely that this casualty was physically incapacitated for the better part of a year.

The pictures of **Figure 2-25** show an injury that is becoming especially common in the Third World: the amputation of a foot or lower extremity by a buried antipersonnel mine. Figure 2-25a shows the casualty after his injury: his foot has been blown off. Figure 2-25b shows how the surgeons have excised all the damaged tissue to allow to for optimal healing of the wound. Figure 2-25c was taken several months later and shows the healed amputation stump and an appropriate prosthesis.

HOW HAS BATTLEFIELD SURGERY AFFECTED MORTALITY AND MORBIDITY?

Measurements of mortality and morbidity are not the only rationale for battlefield surgery. The availability of effective surgery is an important factor in maintaining morale, and there is a moral imperative that society must provide state-of-the-art care for those who are its defenders.

Battlefield surgery can prevent only a minority of combat deaths, and it *cannot* make war safe. This is because 85% to 90% of all combat deaths occur *before* the casualty even reaches the medical system. The military classifies these casualties as killed in action (KIA). In contrast, casualties who die *while being treated* are

The pictures of **Figure 2-24** show an all-to-common injury: bones fractured by gunshots. Figure 2-24a shows a casualty whose thigh bone in each leg has been fractured by separate

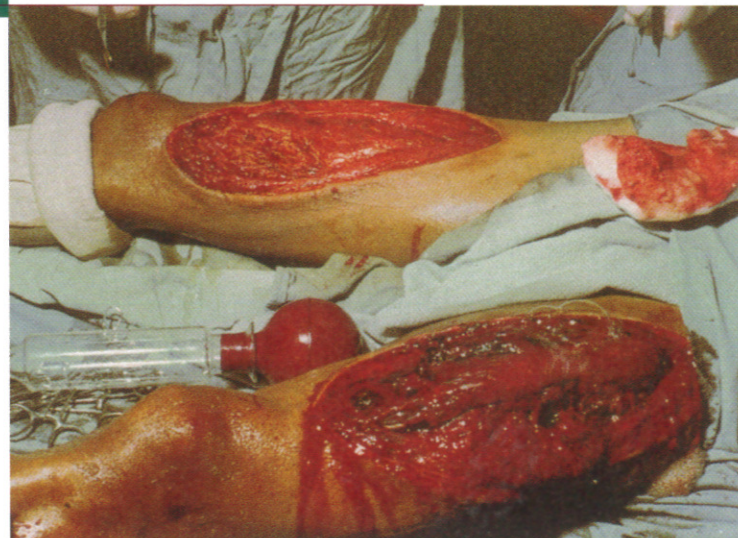
a



b



c



d



Figure 2-24. WDMET database.

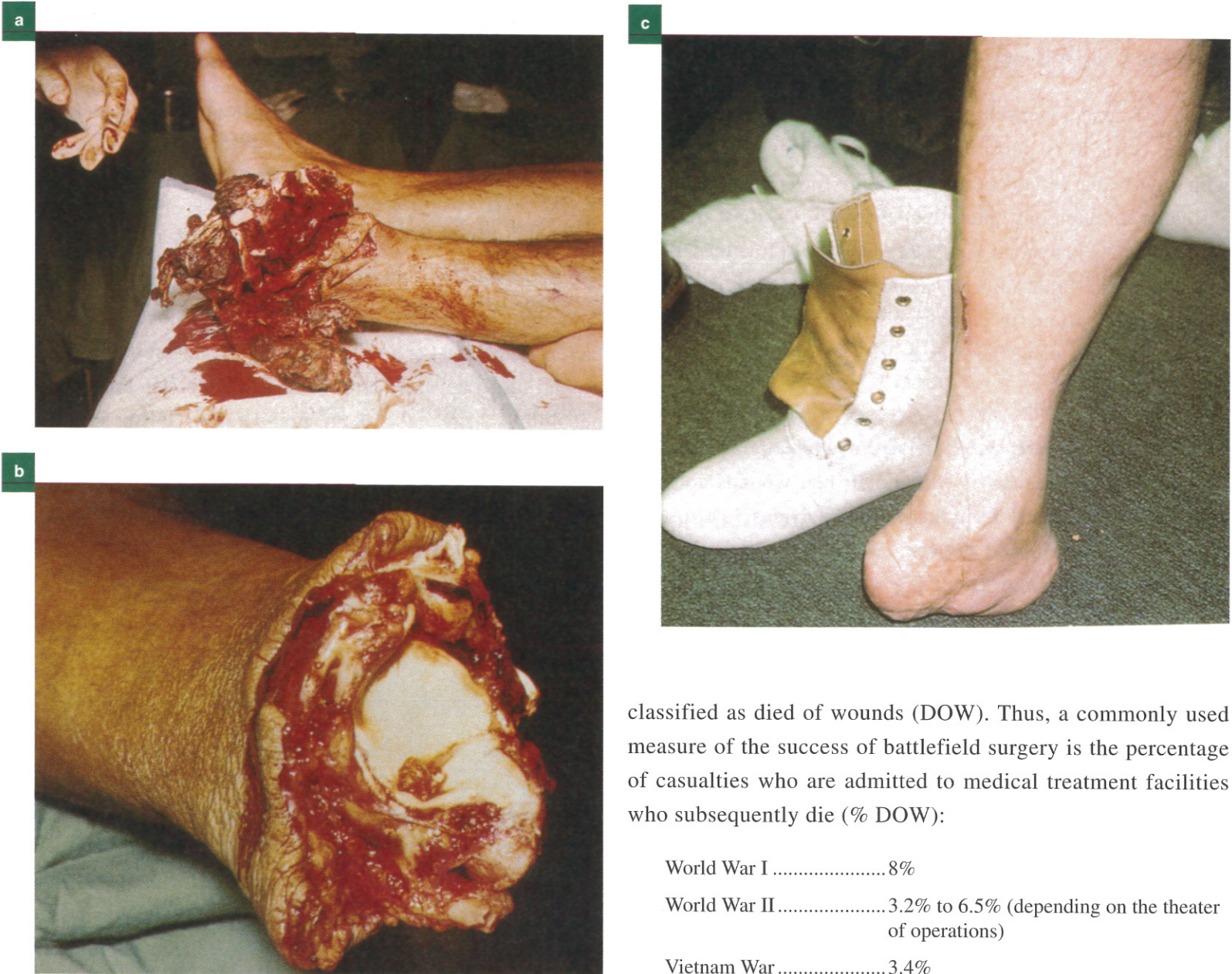


Figure 2-25. WDMET database.

classified as died of wounds (DOW). Thus, a commonly used measure of the success of battlefield surgery is the percentage of casualties who are admitted to medical treatment facilities who subsequently die (% DOW):

World War I 8%

World War II 3.2% to 6.5% (depending on the theater of operations)

Vietnam War 3.4%

Persian Gulf Wars uncertain but probably around 2% to 3%

By way of contrast, the % DOW for Union soldiers in the American Civil War was about 12.5%.

The assessment of morbidity (the lingering effects of a condition) is more difficult to perform. However, there is no doubt that with modern battlefield surgery there are fewer casualties with extremity amputations, and after rehabilitation, they are more functional than in bygone wars; better healing of fractures, better function in the brain-injured casualties; and fewer prolonged septic complications in casualties with chest and abdominal wounds. To document these assertions would require a small book in itself.

Going back to our early theme of lag time, the impressive fall in the percentage of casualties who die of their wounds does not seem to follow directly from the military's extensive efforts to reduce the time elapsed between wounding and battlefield surgery, strangely enough:

World War I The upper limit was set at 12 hours, but 36–48 hours was probably common. However, there are well-documented instances of shorter lag times (wounding to surgical hospital in 4 hours).

World War II Times between wounding and surgery are uncertain and highly variable. One well-documented report from a forward surgical unit in Italy during the summer of 1944 showed an average time of 11.5 hours.

Vietnam War A very short interval is likely, perhaps 1 to 2 hours.

First Persian Gulf War Data not available, but anecdotes suggest that 6 hours or more were not unusual.

Although the data are incomplete, the evidence suggests that factors other than lag time are also in play: the presence of better-trained surgeons, and a more profound understanding of human physiology—not only in the preoperative and postoperative periods but also during the actual operation.

In summary, although battlefield surgery has shown that it is adept at saving lives and alleviating suffering, we need to remember that battlefield surgery does not make war safe.

The single most useful database describing combat wounds and the circumstances of wounding is the Wound Data and Munitions Effectiveness Team (WDMET) study prepared by the US Army Materiel Command during the Vietnam War. These data are stored at the National Naval Medical Center, Bethesda, Maryland. Access is controlled by the Uniformed Services University of the Health Sciences, Bethesda, Maryland 20814-4799; telephone (301) 295-6262. Three summary volumes contain extensive abstracts of the statistical data and can be obtained from Defense Documentation Center, Cameron Station, Alexandria, Virginia 22304-6145; telephone (703) 545-6700 and (703) 274-7633.

BATTLEFIELD SURGERY 101: FROM THE CIVIL WAR TO VIETNAM

Selected Photographs From the National Museum of Health and Medicine

Based on the Exhibit by J. T. H. Connor, Michael G. Rhode, and J. Carey Crane

Due to conservation concerns, all images in this exhibit are reproductions of photographs in the Museum's collections and may vary in color and size from the originals. Captions for the photographs, including ranks, are the unaltered original wording, with any additional new material appearing in brackets.

But one great Cannon at one shot may spoyle and kill an hundred men.....[T]his infernall Engine roares as it strikes, and strikes as it roares, sending at one and the same time the deadly bullet into the breast and the horrible noise into the eare. Wherefore we all of us rightfully curse the author of so pernicious an Engine; on the contrary praise those to the skies, who endeavour by words and pious exhortations to dehort Kings from their use, or else labour by writing and operation to apply medicines to wounds made by these Engines.

—Ambroise Paré
16th-century French military surgeon

Keynes G, ed. *The Apologie and Treatise of Ambroise Paré: Containing the Voyages Made Into Divers Places With Many of His Writings Upon Surgery*. New York, NY: Dover Publications, Inc; 1968: 136.

BATTLEFIELD SURGERY 101: From the Civil War to Vietnam

Medicines and how they were applied to gunshot wounds have changed considerably from Ambroise Paré's day to the present. But a bullet to the chest remained a serious, if not fatal, wound from the 16th century down to the Civil War era and continuing to the years of the Vietnam War. Throughout these centuries surgery on the battlefield was practiced under the harshest of conditions. Frequently the operations were successful with lives being saved, but all too often the best efforts of the surgical team were in vain as they witnessed their soldier-patients die due to the severity of their injuries.

Artifacts in this exhibit illustrate some of the ways and means of treating soldiers on and off the battlefield. The selected medics' kits, field dressings, surgical sets, and prosthetic limbs dating from the early 1900s represent only a portion of the museum's holdings in military medicine over the ages. Making up the bulk of this exhibit is over 100 photographs spanning about 100 years from the Civil War to the Vietnam War. *Battlefield Surgery 101* reveals the evolution of the military operating room and the challenges of the men and women who work there. Drawn from the holdings of the National Museum

of Health and Medicine, Armed Forces Institute of Pathology, the images in this exhibit examine the breadth and depth of military surgical activities.

The camera became a new and useful medical instrument within a decade or so after photography's invention during the 1840s. Throughout the Civil War, the Army Medical Museum (now known as the National Museum of Health and Medicine, Armed Forces Institute of Pathology) amassed a collection of thousands of original photographs of wounded soldiers, pathological conditions, and other medical subjects.

Over the next century camera equipment became smaller and less cumbersome, multiframe film in rolls replaced single glass plate negatives, and exposure times shortened. These changes in technology allowed photographers to capture more action-oriented scenes, although some shots were still staged. During this time photographers turned up at both the bedside and the battlefield to record medical scenes that ranged from the mundane to the heroic to the ghastly. The images that they took served many purposes: training, military intelligence, forensic evidence, propaganda, and recreation.

Many of these images are being displayed to the public for the first time. Due to the graphic nature of some of them, some people may be shocked. In selecting the photographs, the exhibit's curators tried not to be sensationalistic. Rather, they wished to present realistic perspectives of the danger and challenges facing both fighting soldiers and the men and women whose duty it is to care for them when they are in harm's way.

J. T. H. Connor, Ph.D.
Michael G. Rhode
Curators



A time bomb, planted in Countances, France, by the retreating Nazis, goes off, injuring several GIs. Medics treat one of the injured. Debris in the foreground is part of a jeep blown across the street by the blast. July 31, 1944. NCP 4116.



Aid man Pfc. Richard C. Drapper (Shaker Heights, Ohio) of the 1st Battalion Medical Section, 337th Section, 337th Regiment, 85th Division, dresses a shrapnel wound on an injured soldier in Grande area, Italy [circa World War II]. SC 202190.



Korean Conflict. A member of Co. E, 187th Rgt, US Eighth Army, with a bullet in his back, is given a morphine injection by a medic, in Korea. March 28, 1951. SC 361977.



Korean Conflict. Pfc. McCullen (Elizabeth City, North Carolina) bandages a small shrapnel wound in the leg of his buddy, Pfc. Englohart (New Cumberland, West Virginia). August 24, 1950. SC 346914.



Hammock and bamboo pole used by two male VC/NVN to evacuate their wounded two hours to aid station [circa Vietnam War].



A leg operation being performed on a communist captive at the 3rd Field Hospital in Pusan, Korea. Performing the operation are Maj. Joseph Conroy, Maj. Ben Musser, and Capt. Burton Canfield. January 5, 1951. SC 358552



Snapshot of surgery at 131st General Hospital, England, during WWII. Rosenberg 17



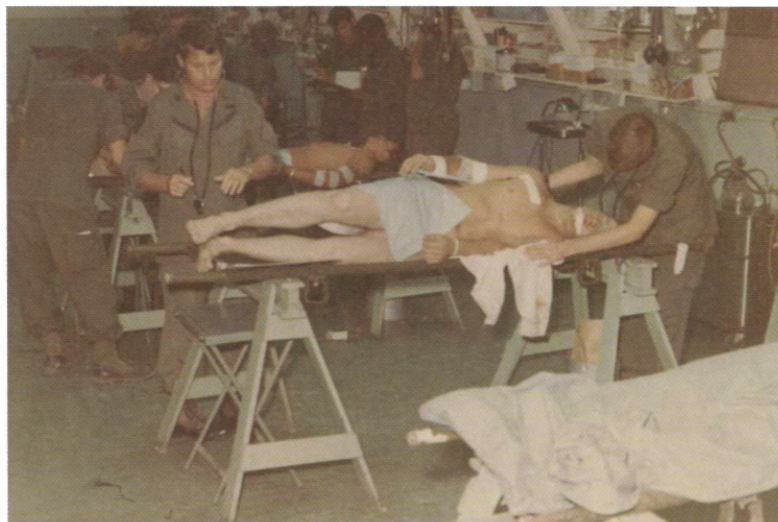
Kim Pung Yong, a South Korean soldier, receives medical treatment at a forward medical aid station, preparatory to evacuation to a hospital in the rear. September 15, 1950. SC 348574



First aid station. Ambulance Co. 103. Ambulance Co. 104. Wounded German prisoners receiving first aid treatment. WWI/Reeve 17421.



Operating room with patient on table. Army Medical Dispensary. WWI/Reeve 984.



[Patient being turned to prevent aspiration of vomitus after wounding during the Vietnam War.]. Swan 246-A.



Wounded evacuated on jeep [circa World War II]. NCP 4139



Surgery tent of a medical battalion on Bougainville Island, showing operating table made of blanket wrapped litter supported by packing cases. South Pacific. November 1943. SC 186565



The wounded, resting on litters, are transported by jeep from the battalion aid station to a clearing station, and finally to the underground surgery room. 1943. SC 187246



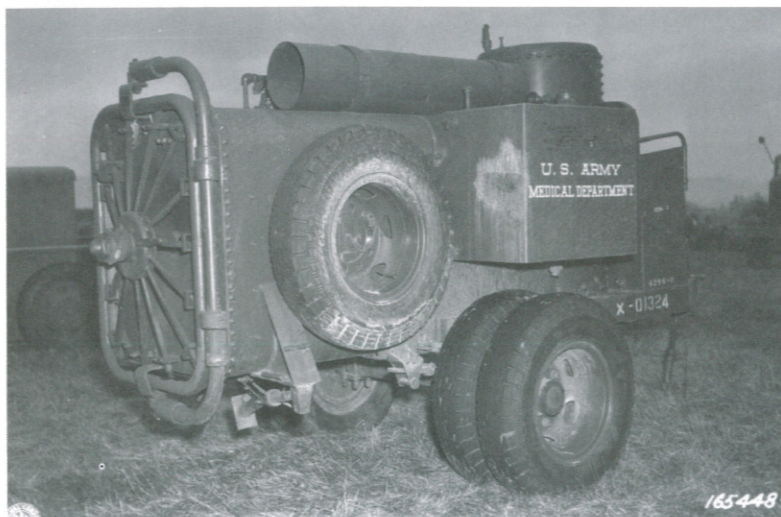
Blood plasma is given to the wounded at a medical station near the front line somewhere in the South Pacific during World War II. NCP 1738



An enlisted man of the 26th Portable Hospital applies an adhesive bandage to the stomach wound of a patient. Biak Island, Dutch New Guinea. June 18, 1944. SC 239005



Sgt. Ralph Lanhan (Orrville, Ohio), 38th Infantry Regiment Medical Section, treats the foot of a member of the regiment, wounded in the bitter battle for Hill 1179. July 30, 1951. SC 376097



Medical Corps field sterilizer. England. January 1943. SC 165448



Treatment of wounded at a battalion aid station below Bologna, Italy. April 19, 1945. NCP 4128



Wounded arriving at triage station, Suippes, France, from sanitary train. WWI/Reeve 17413



Bamboo surgical tables. Vietnam. 46-1



Evacuation of wounded on a half-track truck across a temporary bridge [circa World War II]. NCP 4118



French x-ray truck and the generator that supplies light to the tents, formerly the Yale University Mobile Unit. December 19, 1918. SC 3341



American wounded receive treatment in the square at Troyes, France. August 26, 1944. NCP 4120



Medics treat wound in right thigh. NCP 4135



Medics operate in tent on patient with multiple leg wounds. NCP 4136



Military surgical operation with unmasked anesthetist observing. NCP 4141



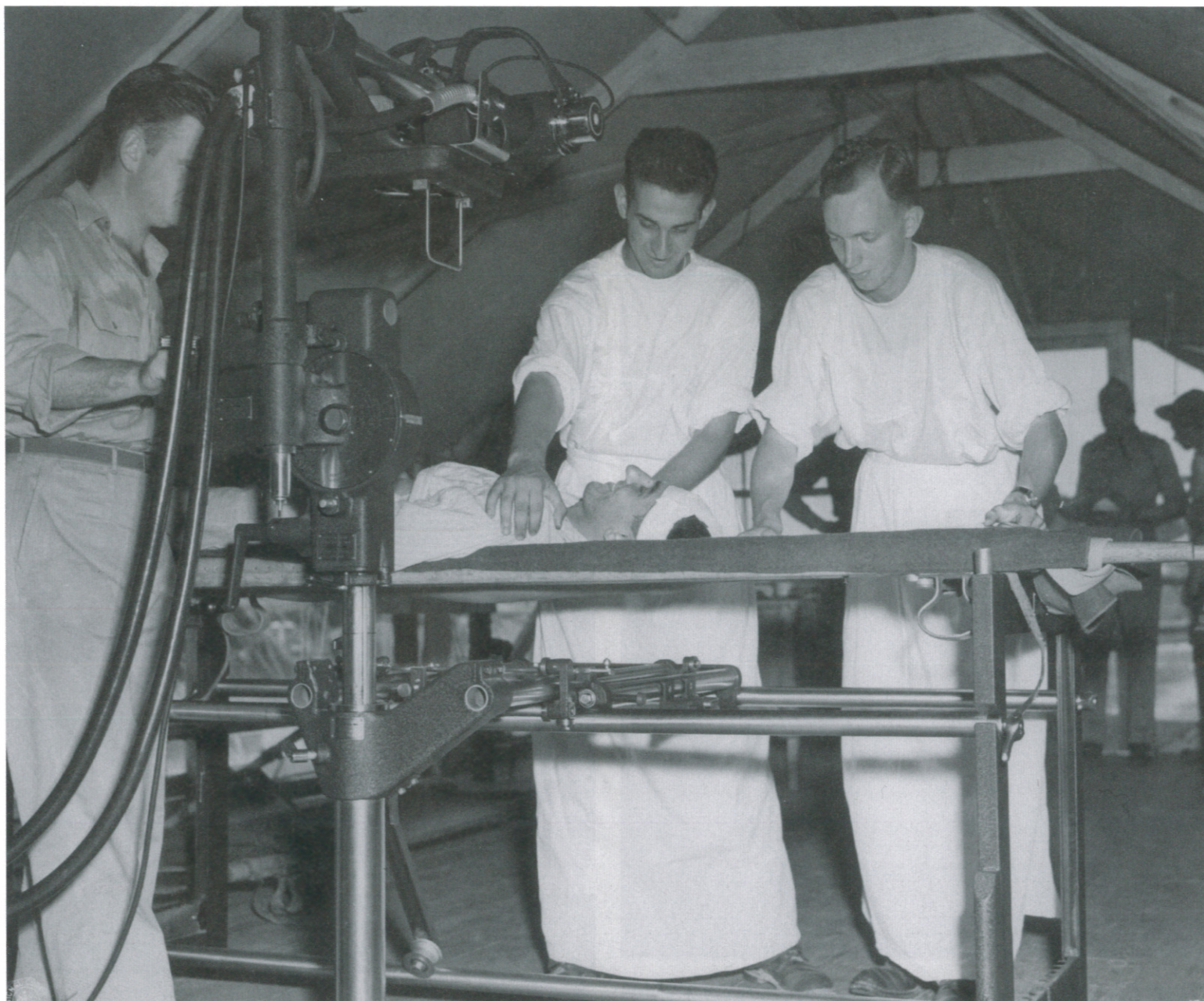
Medics administer blood plasma to an American casualty wounded when his division command post was shelled. Leyte Island, Philippines. October 22, 1944. SC 196094



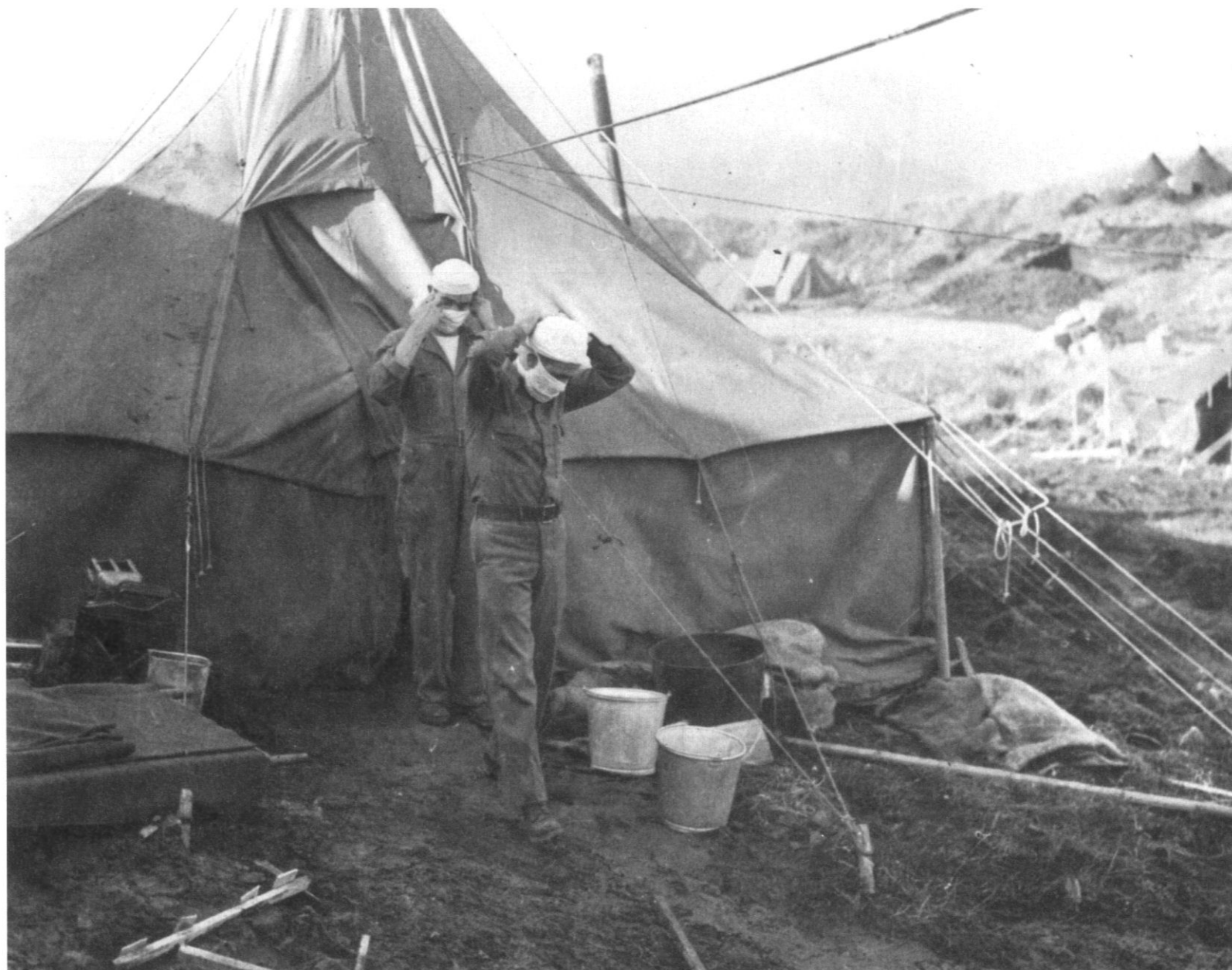
Military doctors operate in tent with full surgical preparation. NCP 4142



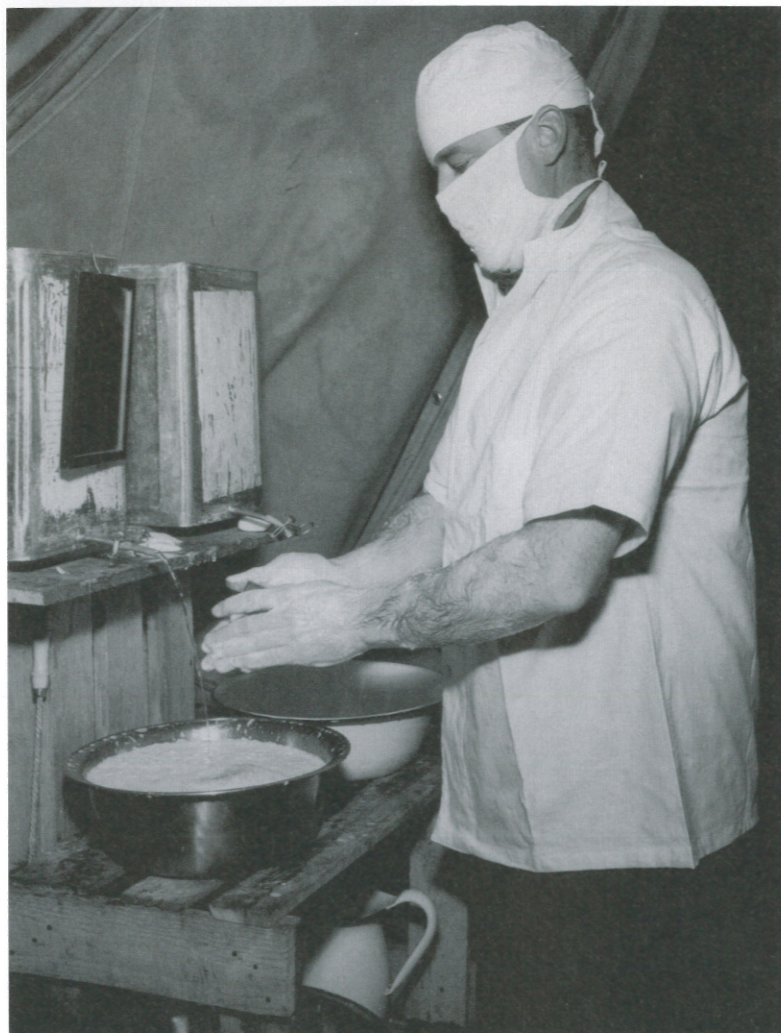
Soldier wounded when Japanese air-raided an airstrip somewhere in New Guinea. Cpl. Henry Chum (Washington, DC) received plasma at field hospital. New Guinea. May 11, 1943. SC 169336



Army field maneuvers in the Carolinas, 1942. The x-ray room in the 6th Evacuation Field Hospital. SC 139639



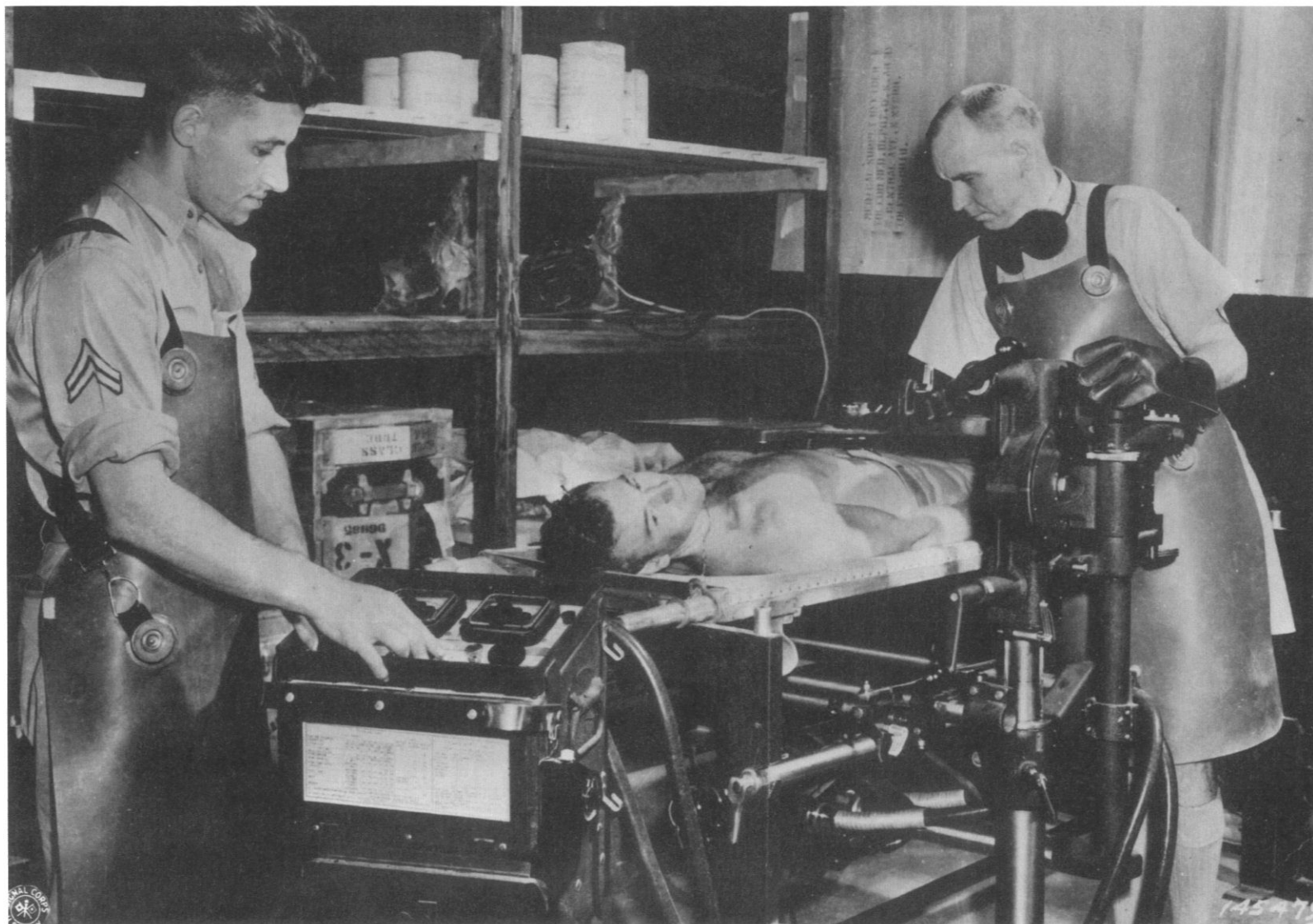
The operating tent of the base hospital. The two soldiers exiting have just helped in an operation and are going outside to get a breath of air. Alaska. 1942. SC 139815



The island base hospital is housed in a series of tents. This doctor is washing his hands in the hot water coming from two five-gallon cans. There is no plumbing, and this is the only system used for the purpose. A common coal stove heats the water to the necessary boiling point. Alaska, 1942. SC 139817



Amputation of third, fourth, and fifth metacarpals. Pvt. Robert Fryer, Co. G, 52nd NY Volunteers, wounded at Hatcher's Run, Virginia during the civil war. CP 1041.



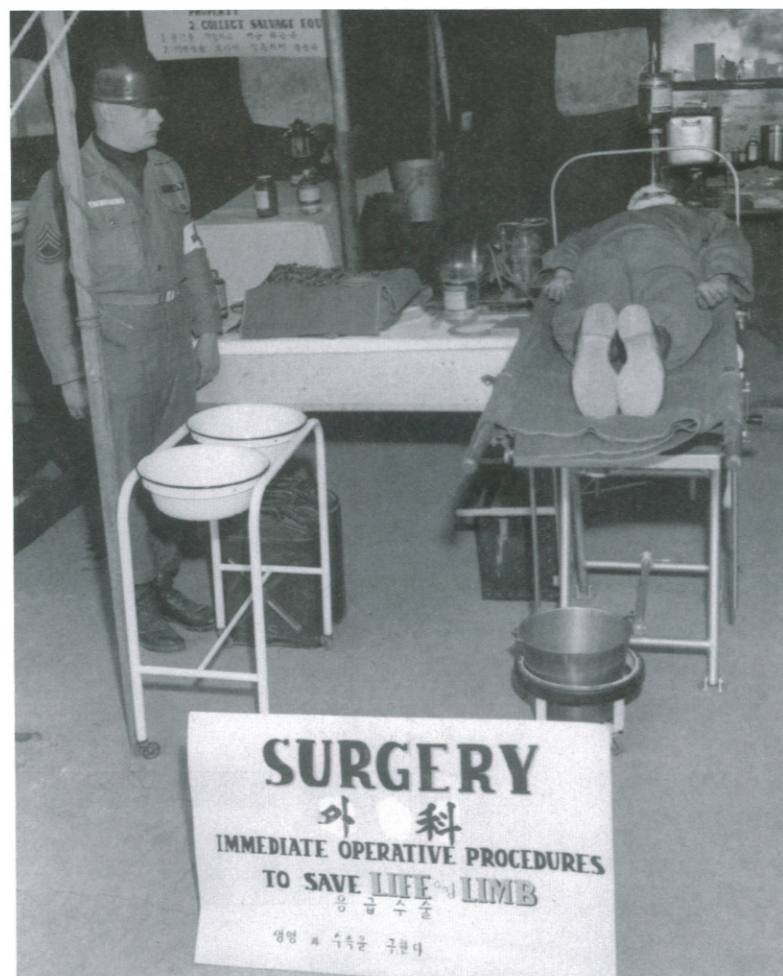
U. S. Army Station Hospital in India. 1942. SC 145479



General view of interior of surgery tent, showing an operation in progress at the far end. North Africa. December 12, 1942. SC 164145



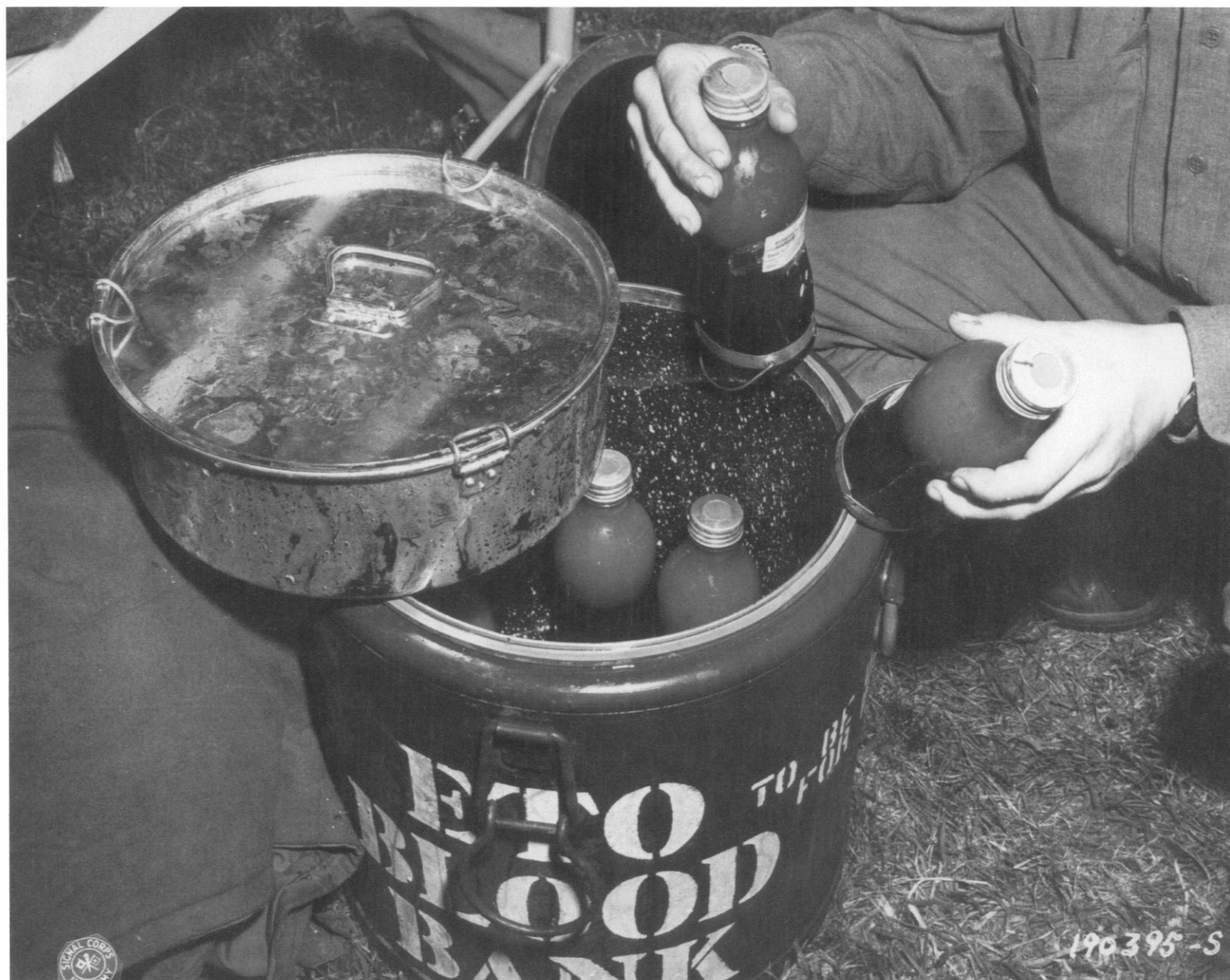
Operating room of the surgical hospital. Patient is suffering from gunshot wound in the left leg. North Africa. April 4, 1943. SC 175100



Sfc. Nibbe of the 618th Medical Corps stands by the surgical section designed to permit life-saving operative procedures. NCP 1908



New surgical work being done on New Georgia Island by members of the 30th Division Clearing Corps (medics). This picture shows the concluding procedures in the treatment of chest wounds, when the air is drawn from pleural spaces by a hose. August 18, 1944. SC 186540



Close-up of container that holds whole blood shipped to field hospitals in France. The container also holds dry ice to keep the blood at its proper temperature. 120th Evacuation Hospital, France. June 12, 1944. SC 190395



Close-up of feet of two soldiers suffering from trenchfoot [circa World War II]. SC 196768



In a hastily constructed tent on Okinawa, U. S. 10th Army medics complete a cast on a soldier wounded by shell fragments. Assistants, meanwhile, administer blood plasma. April 9, 1945. SC 207917



Capt. Bernard Sollard (Baltimore, Maryland) and Capt. Sidney Kahn (Chicago, Illinois) assisted by Pfc. Gregory A. Mattio (Walsenburg, Colorado) perform a brain operation on a wounded man. These men are members of the 26th Portable Hospital. SC 239006



Wounded Charlie at VC Field Hospital [circa Vietnam War].



Army Medical Wagon. [Posed Civil War amputation scene.] NCP 1563



Cpl. Kirby Alexander, blood station, 6th Army Medical Depot, puts blood into a special refrigerator that keeps blood between thirty-eight and forty-two degrees Fahrenheit. August 1, 1951. SC 376747



354716

M/Sgt. G. J. Miller (Clementon, New York) selects human blood for a patient at the 8076th Army Surgical Hospital at Kunu-ri, Korea. November 27, 1950.
SC 354716



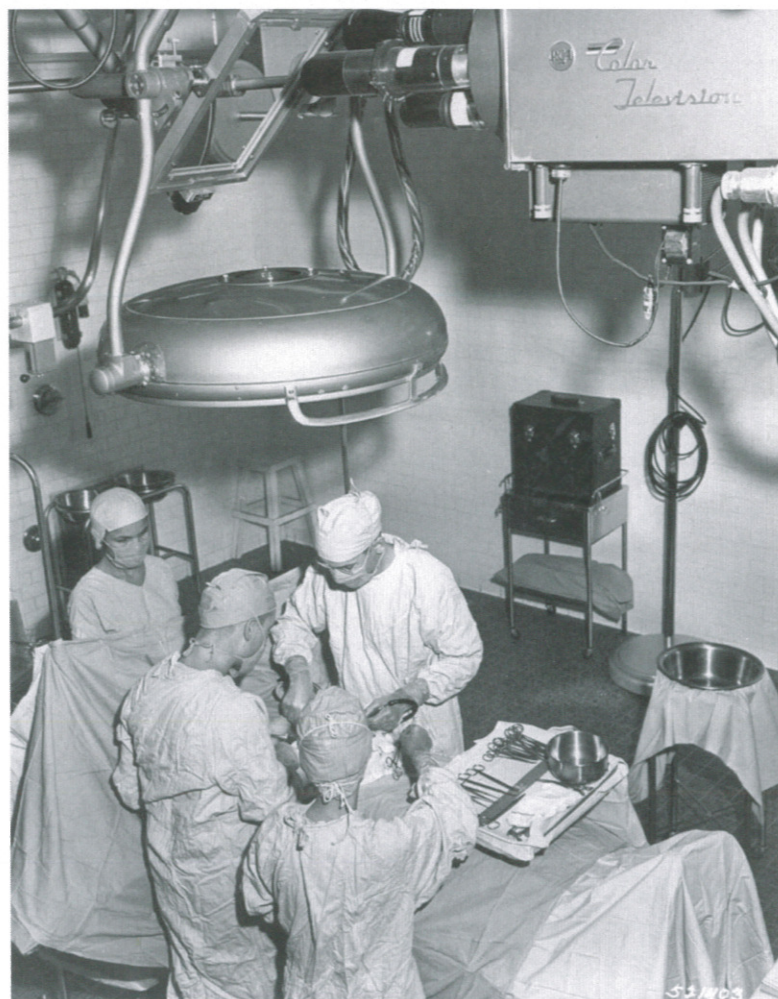
Lt. Mary O. Jones (Limestone, Tennessee), Army Nurse, cares for a badly wounded Chinese communist captive in her ward at a mobile hospital in Korea. December 26, 1950. SC 355390



Operation for hernia, Walter Reed Hospital, showing motion picture camera in action. 1918. Walter Reed General Hospital. WWI/Reeve 562-B



Evacuated wounded transferred by stretcher from ... plane to ambulance. NCP 4124



The color television camera in Operating Room #6, Walter Reed Army Hospital, is equipped with a turret of lenses of various focal lengths. The camera looks at the surface of a mirror, which is suspended at an angle above an aperture within the center of an operating light that is always focused on the operating field. Around the operating table are Capt. Crisonia Tirado-Gonzales, anesthetist; Capt. Alphose C. Gomez, surgeon; 1st Lt. Norman D. Sower, surgical assistant; and Capt. Dorothy Goldsmith, scrub nurse. November 14, 1957. SC 521403.



First aid: interior of an advanced dressing station operating theatre. British Army. WWI/Reeve 805



One of the operating rooms, Mars Hospital Center. WWI/Reeve 13424



Wounded evacuated by stretcher onto hospital train. NCP 4138



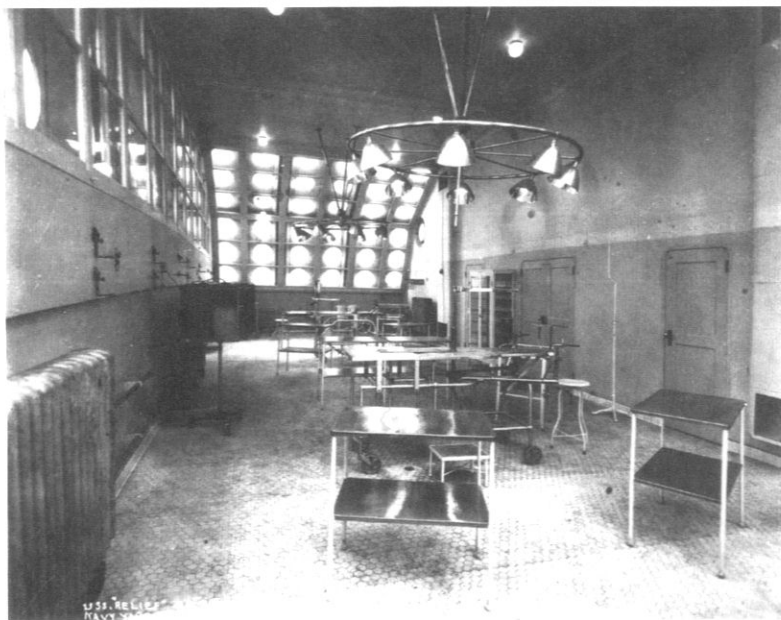
Evacuation—loading patients on hospital train. NCP 4121



A surgical operation [aboard a hospital train circa World War I]. NCP 2440



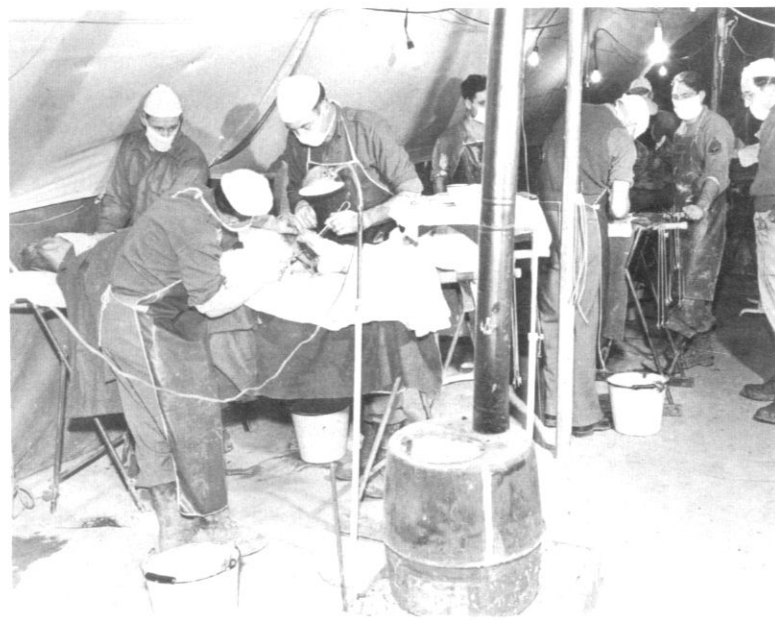
Operating Room, 131st General Hospital, England, during World War II. Rosenberg 5



USS *Relief*, operating room (starboard to port). Navy Yard, Philadelphia, Pennsylvania. February 14, 1921.



Nurse and doctor relax outside of operating room at 131st General Hospital, England, during World War II. Rosenberg 6



Operating room in an evacuation hospital near Luneville, France, 1944. NCP 1739



Medical corpsmen attend patients awaiting surgery while surgeons operate on others on platform (rear center) at the 60th Field Hospital in St. Max, France. October 3, 1945. SC 210134



Operation on John Coolidge performed at 1st Field Hospital Unit. June 16, 1918. SC 14775

a

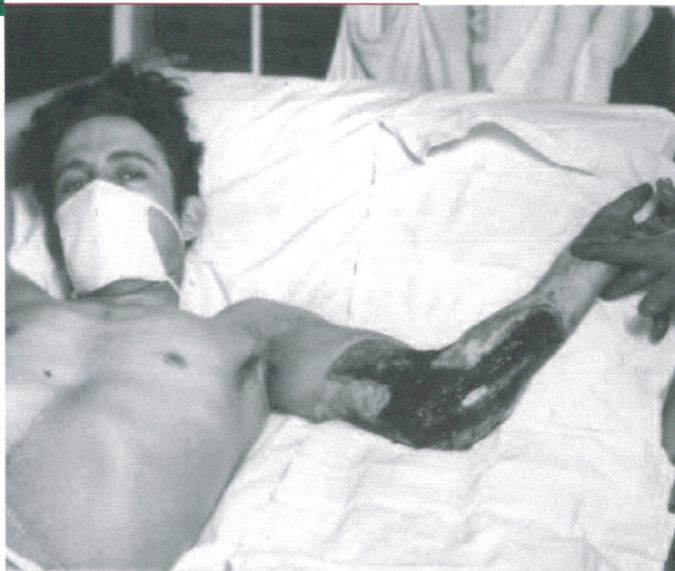
1 June 1944



Patient loaded onto [ambulance circa World War II]. NCP 4137

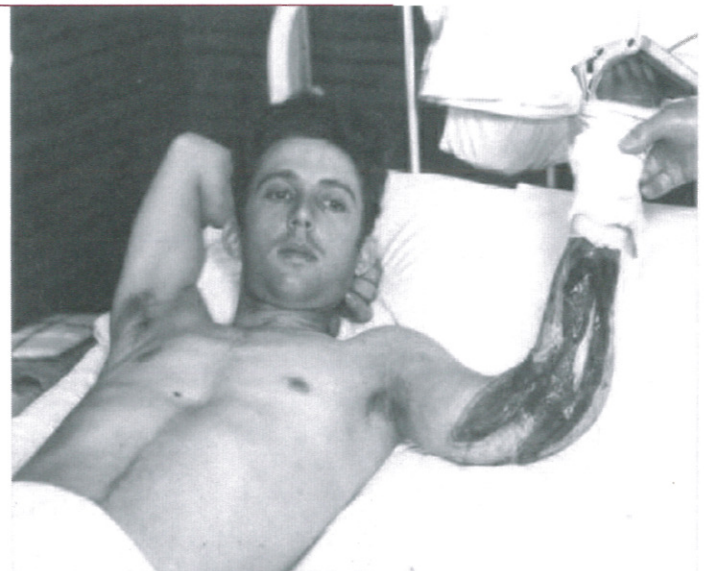
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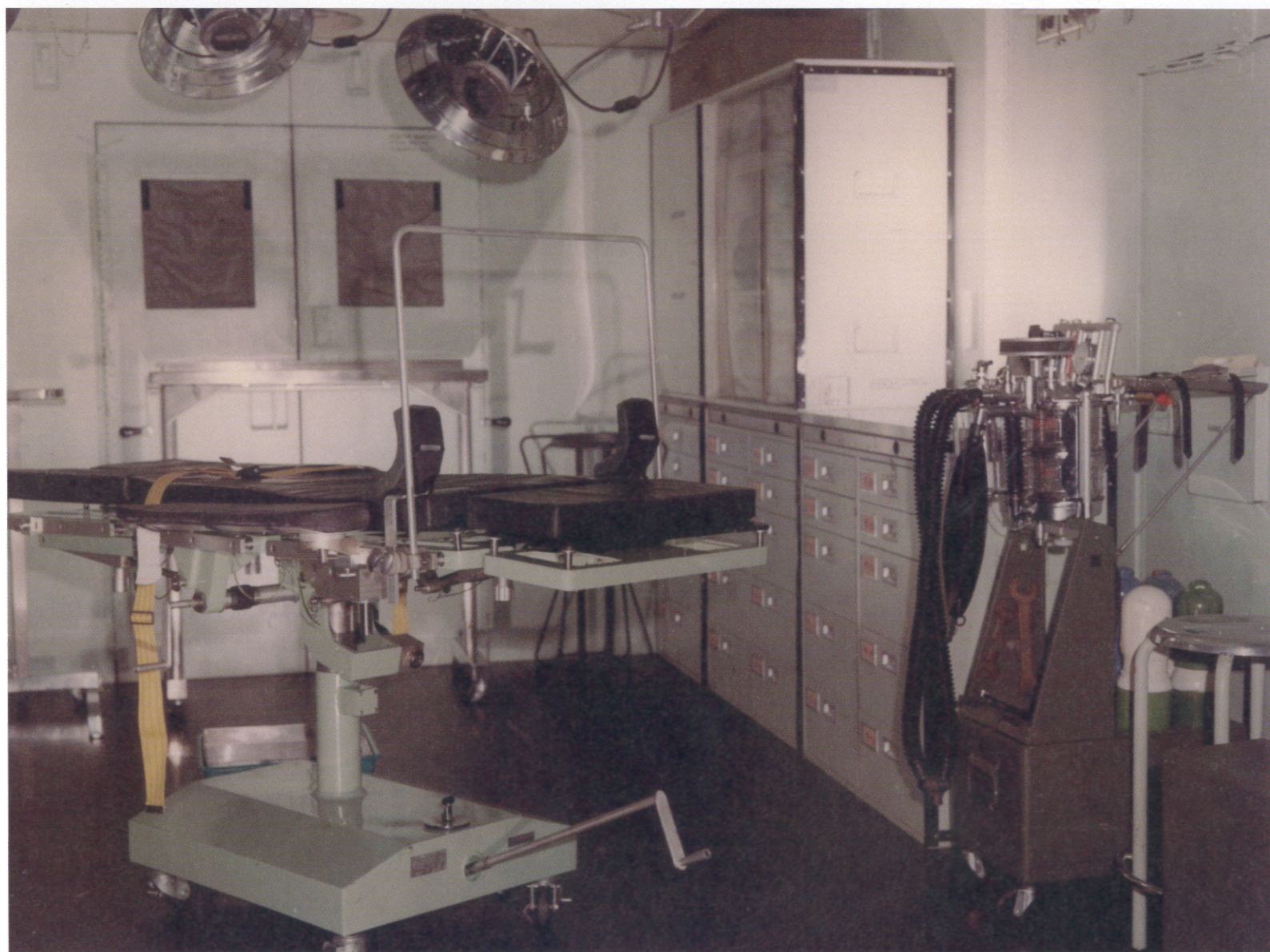


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20 June 1944



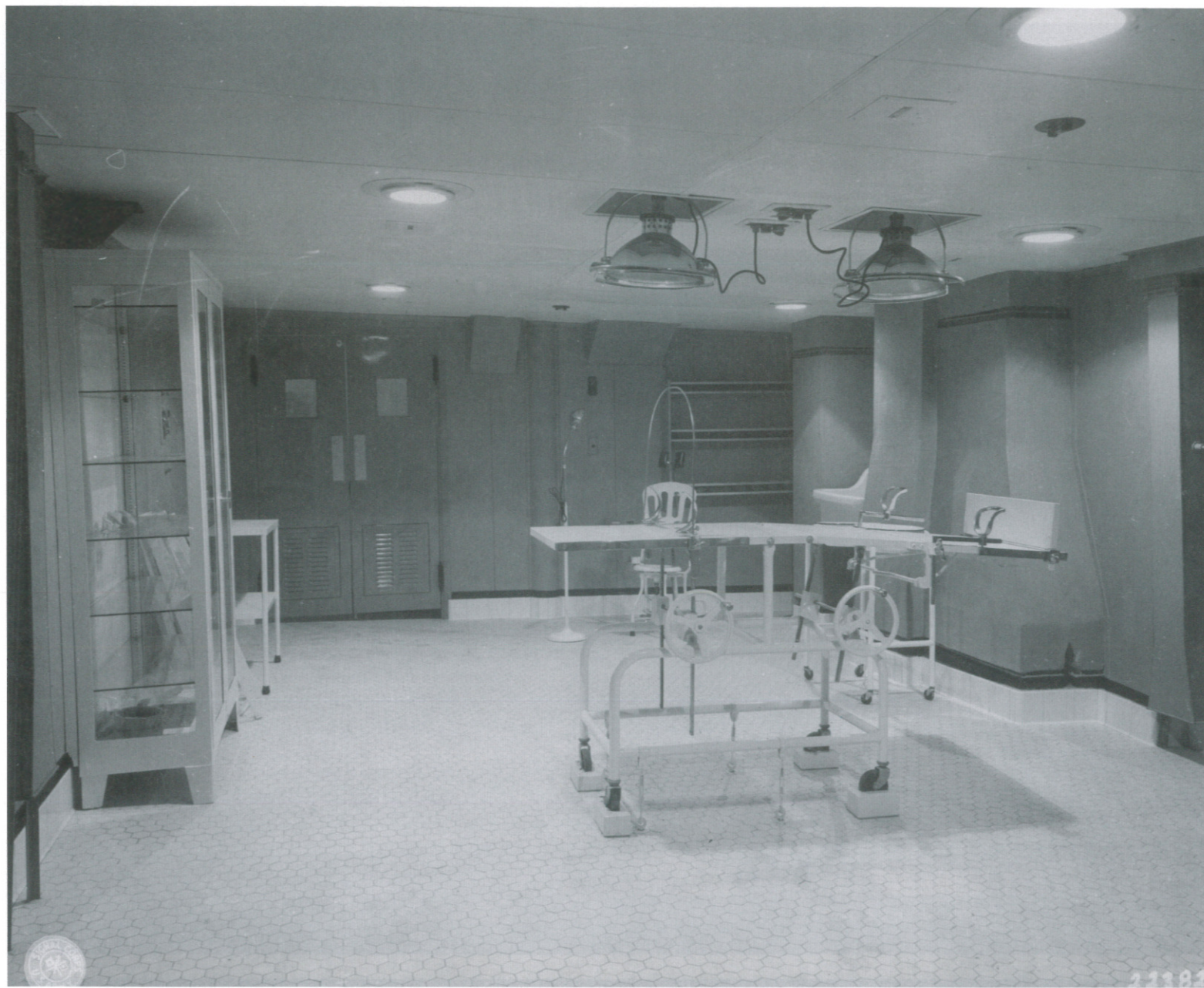
Fractured left humerus with gas gangrene. Borden General Hospital. NCP 4130-4132



An operating room in the Medical Unit Self-contained Transportable (MUST) at Ft. Sam Houston, Texas [circa 1960s]. NCP 195



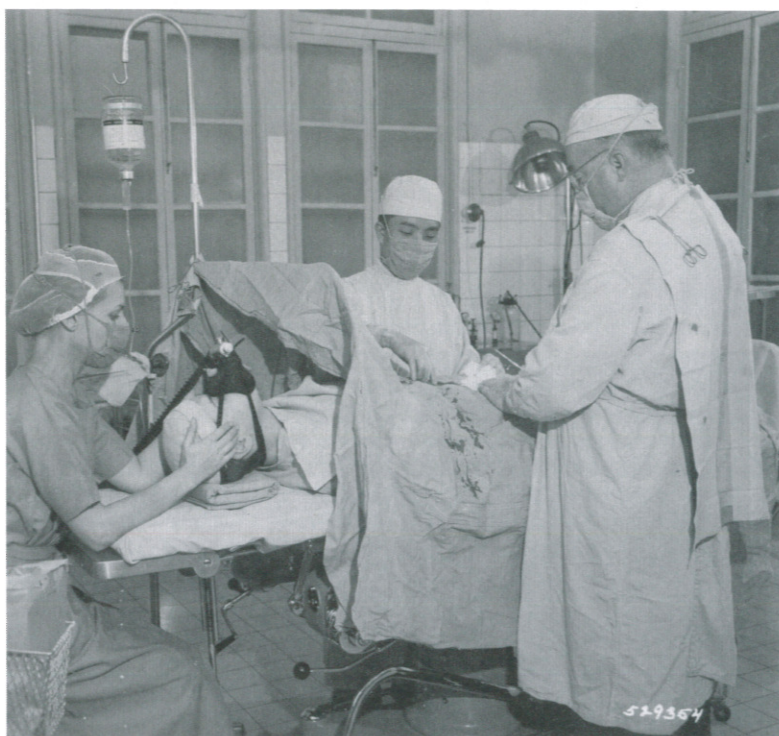
Capt. Shaddock, assisting nurse, and patient suffering from a gangrene infection. Australia. September 21, 1942. SC 169497



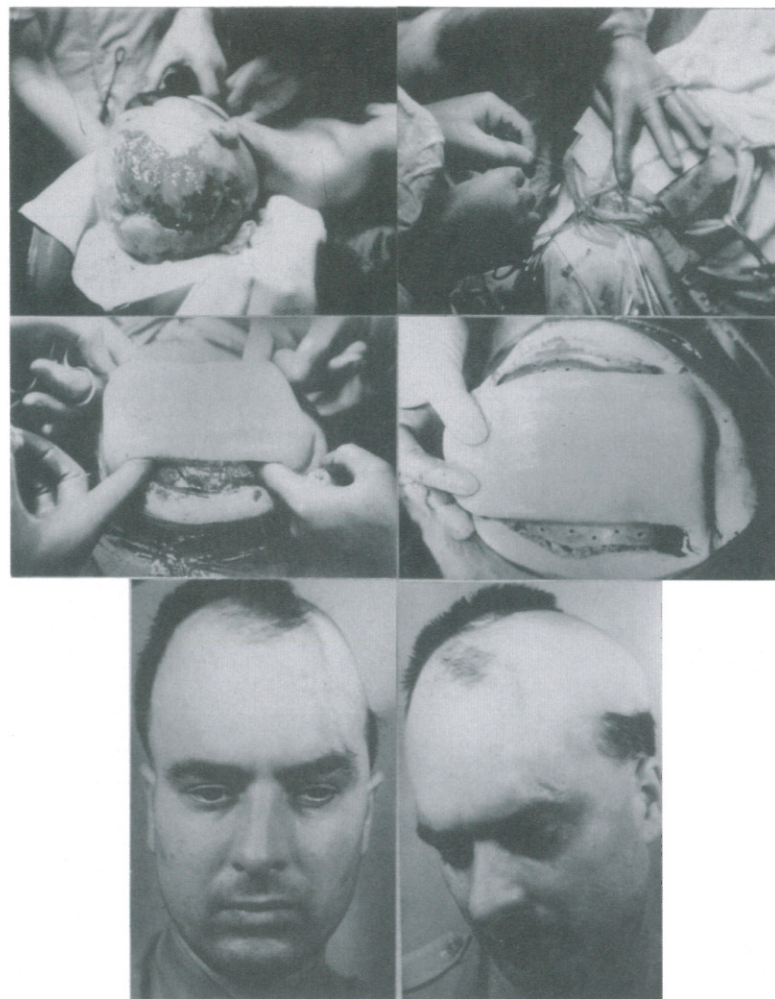
A dressing station on the U. S. Army Hospital Ship *Milne*. 1st Service Command, 1945. SC 223829



Cdr. Bruno O. Junnila and HM/3 Harry Palo, x-ray technician, prepare to x-ray Pfc. George E. Anthony's arms, as Lt. Rita K. Camp (Warren, Ohio), nurse, stands by to assist, aboard the USNS Hospital Ship *Repose* [circa Korean War]. SC 356231



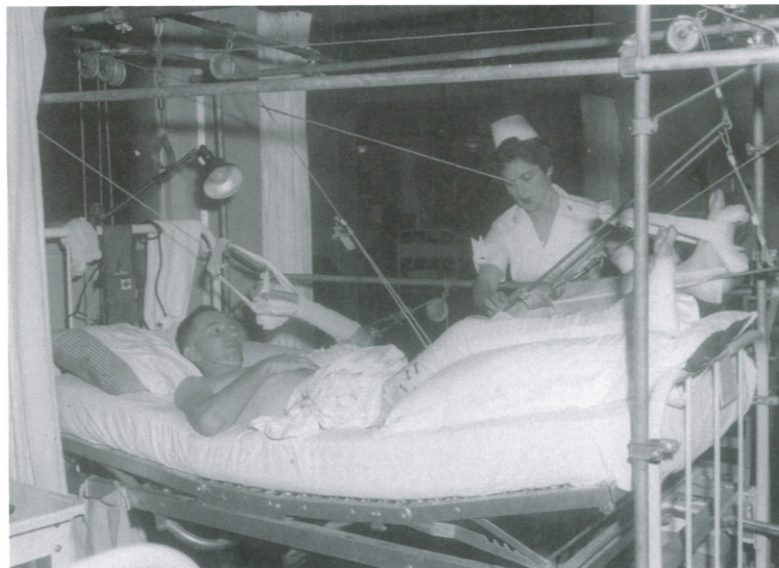
Dr. Masami Sakuri of Osaka City University assists Col. Ed J. Doyle (Columbus, Ohio) during an operation at the U. S. Army Hospital. The anesthetist is Capt. Carolyn Rahm (Sherman Oaks, California). November 1, 1957. SC 529354



Full-thickness flaps being closed over metal plate in casualty with huge skull defect. NCP 1690



Diseased tissue is removed during a lung operation performed at the Tokyo Army Hospital, 3059th Airborne Unit. Tokyo, Japan. November 3, 1954. NCP 4119



A nurse attends a patient in traction at the Brooks General Hospital, Ft. Sam Houston, Texas. The patient is suffering from a complete comminuted fracture of the right tibia and fibula, double fracture in the shaft of the left humerus, and midshaft fracture of the left femur. SC 323382



Nurses assist in military surgical operation. NCP 4140



Surgical personnel and patient in operating room at Camp Hospital 33, Brest, France. December 31, 1918. WWI/Reeve 13693



Treating patient in operating room. [Taking an x-ray with a field unit.]
NCP 4123



Dr. Anita McGee and an American nurse observe an operation in Hiroshima General Hospital during the Russo-Japanese War, 1904.
Photograph by Herbert Ponting. McGee 205



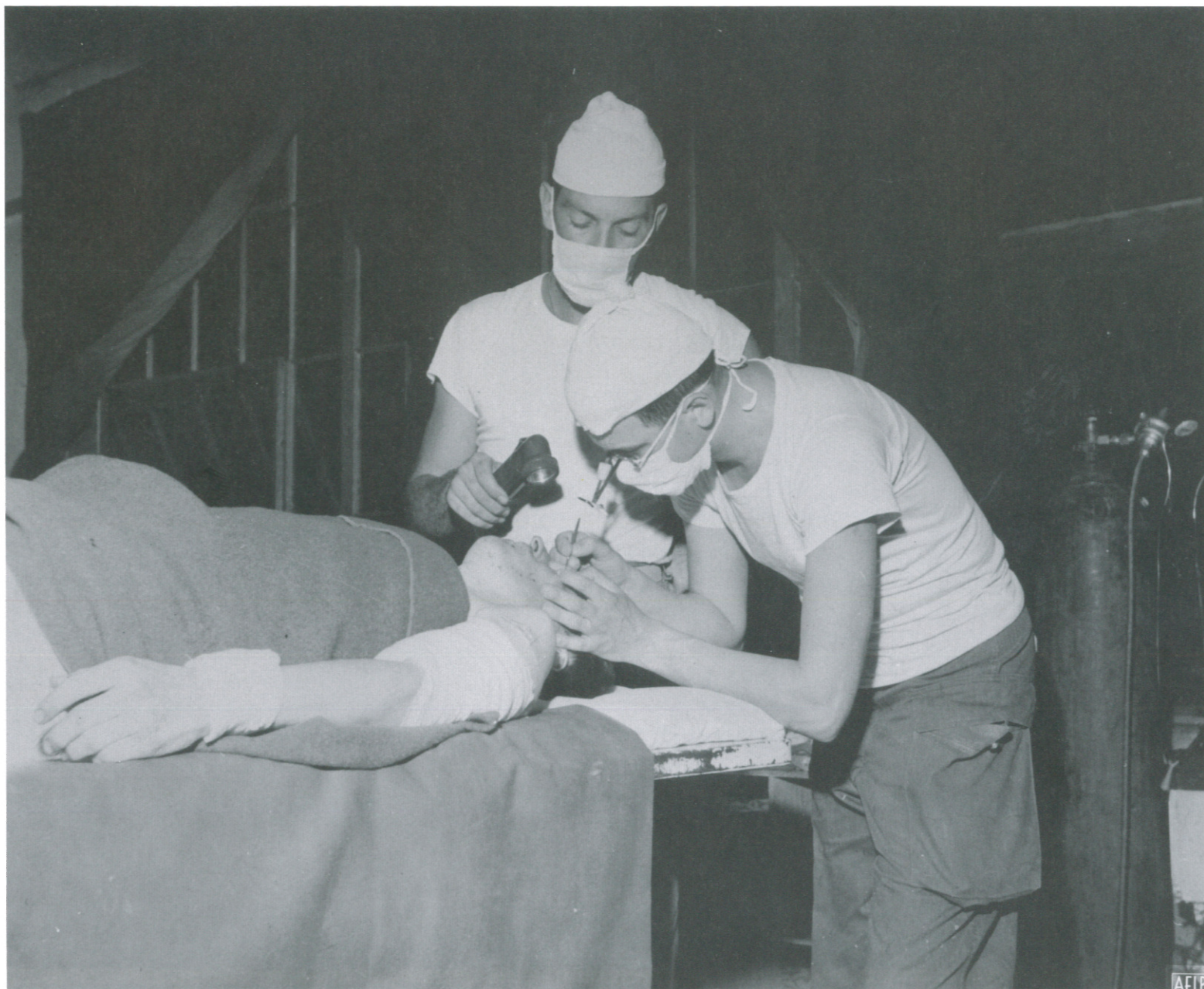
Officers ward at US Army Hospital in India, August 1942. (Left) Capt. Ivan W. Scott (Indianapolis, Indiana), Ward-officer, and (right) Capt. Robert S. Crew (Chestnut Hill, Pennsylvania), Chief of Medicine, give Capt. Frank H. Washow (Belleville, Michigan) the final check-up before releasing him. SC 145482



The interior of the operating room in Ancon Hospital, Panama, during the French Canal days. View taken about 1900. NCP 168



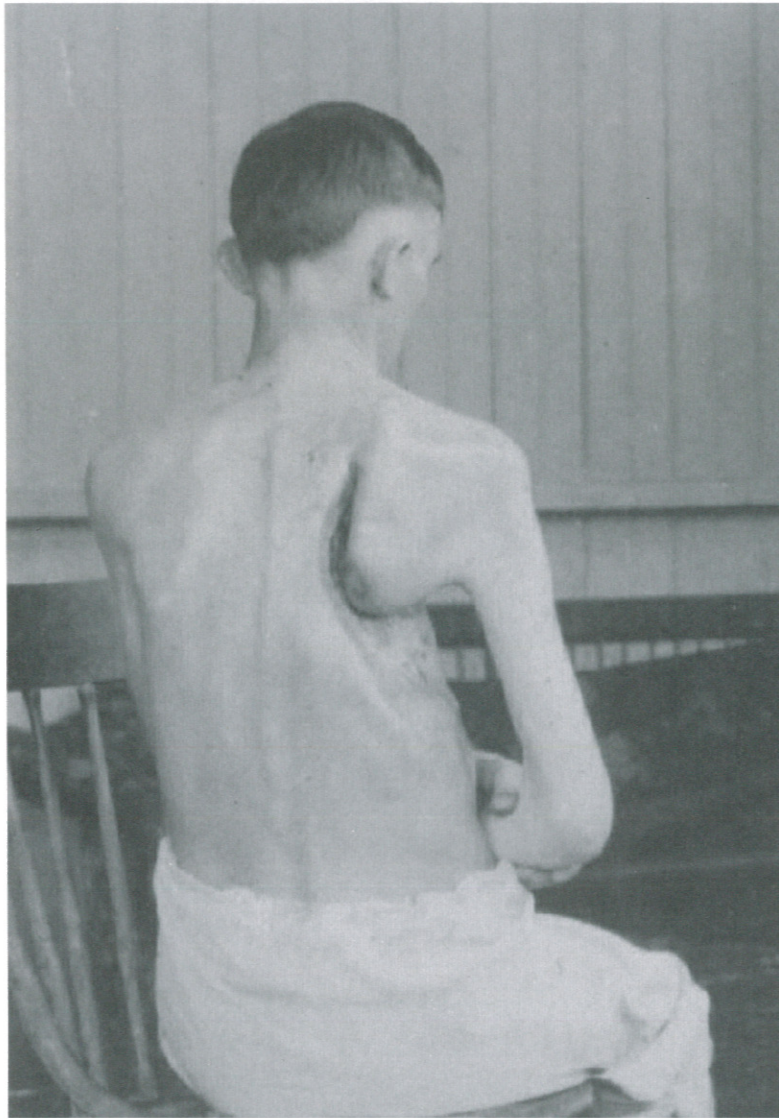
Operating room, St. Nazaire, France [circa World War I]. NCP 2439



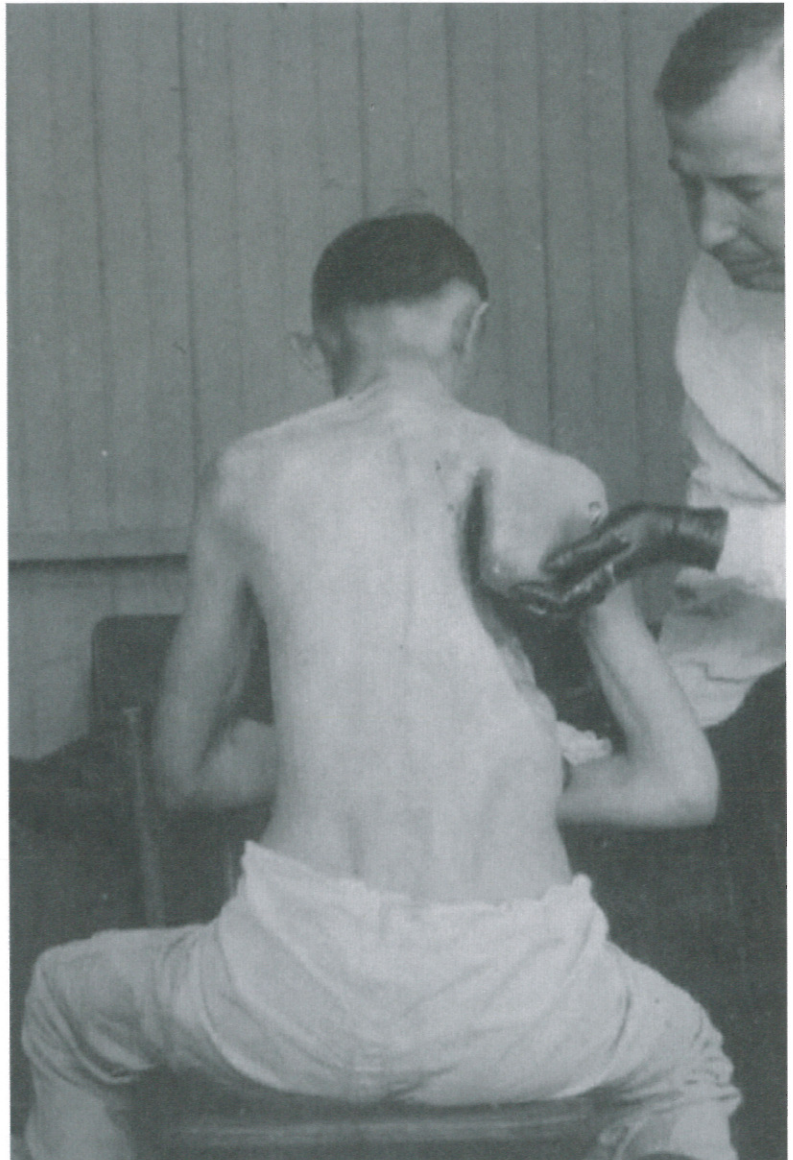
Eye surgery. NCP 1891



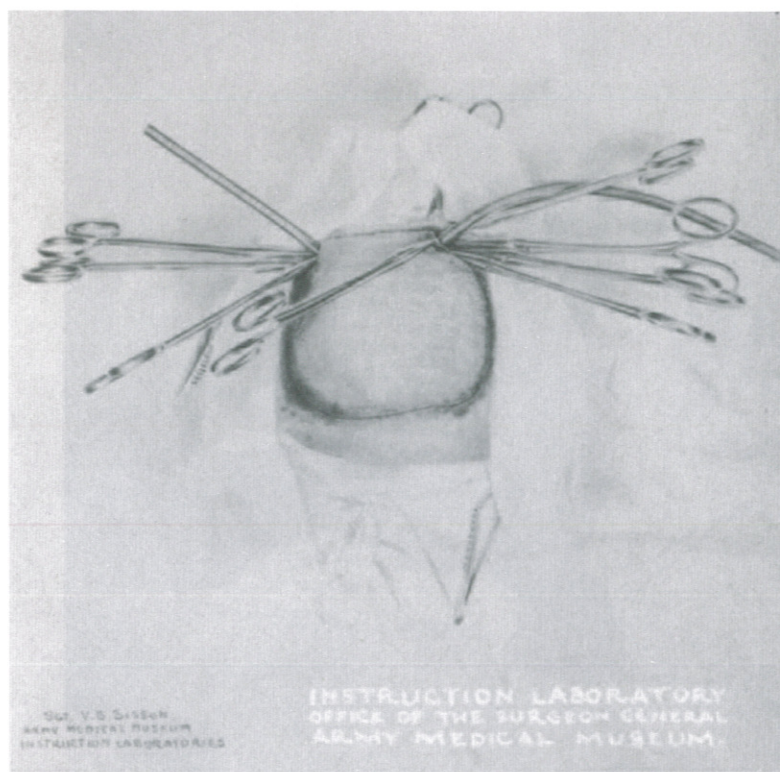
Operation being performed in the portable hospital operating tent. Australia. November 27, 1942. SC 165543



[This patient was treated during World War I. At that time, this disfiguring operation was the only effective treatment for chronic empyema resulting from an infected missile wound of the chest. Most of the ribs on the right side of the thorax have been removed, causing a permanent collapse of the lung and obliteration of the infected pleural space.] WWI/Reeve 347



[This picture shows how the shoulder has been detached from the chest. The operation is rarely used today.] WWI/Reeve 348.



Brain operation for decompression performed at Johns Hopkins. Photograph retouched by Sgt. Sisson for Maj. Neifzeiger. WWI/Reeve 913.



Capt. D. G. Calder, center, assisted by 1st Lt. Claude W. D. Perry, right, and Tech. George W. Foote, performing a surgical operation somewhere in North Africa. December 2, 1942. SC 164144



Sgt. Robson and Pvt. Parrotti, both of Orange, New Jersey, show each other the Purple Hearts they were awarded after being wounded in the engagement in North Africa. They were wounded in the same action at Safi, Morocco, and brought back on the transport. They occupy adjoining beds at Walter Reed Hospital, Washington, DC, where they are in high spirits and recovering from their wounds. SC 165259

BATTLEFIELD SURGERY 101: From the Civil War to Vietnam

Photographs Included in the Exhibit

NCP	*168	*139817	AEF- 447
	*195	*145479	
	1428	*145482	AMM 2184b
	1429	*164145	McGee*205
	*1563	*165259	
	*1690	*165448	CP *1041
	*1723	*165543	1043
	1737	*169336	2926
	*1738	*169497	2936
	*1739	*175100	2945
	*1891	*186540	3085
	*1908	*186565	
	1922	*187246	WWI/Reeve 176
	*2439	*187247	*347
	*2440	*190395	*348
	2622	*193775	*562b
	*4116	*196094	563b
	*4118	*196768	*805
	*4119	*202190	*913
	*4120	*207917	*984
	*4121	*210134	1171
	4122	*223829	*13424
	*4123	*239005	*13693
	*4124	*239006	17406
	4125	*264544	*17413
	*4130	*323382	*17421
	*4131	*345715	17439
	*4132	*345836	17494
	*4135	*346914	32937
	*4136	347070	32938
	4137	*348574	32939
	*4138	*349961	35189
	*4139	*354716	35190
	*4140	*355390	35200
	*4141	*356231	35204
	*4142	*358552	125111
	*4143	*361977	
		*376097	Rosenburg *5
		*376747	*6
SC	*3341		*17
	*14775	*521403	
	*139639	*529354	*Selected photographs, Vietnam
	*139815	548660	War Collection OHA 351

Artifacts Included in the Exhibit

Limbo Minutes (Emergency Evacuation), film, U.S. Army, ca. 1970s, WRAIR 2-92009

Army Field Medic's Bag, German Armed Forces, World War II, M-660 00366

First Aid Kit, North Korean Army, Korean War, M-660 00278

First Aid Kit, U.S. Army, Vietnam War, M-660 10968

Surgical Kit, Imperial Japanese Army, World War II, M-129 00109

Field Surgical Kit, German Armed Forces, World War II, M-151 11742

Muley Leg Prosthesis, United States, ca. 1970, M-129 11192

Leg Prosthesis, United States, ca. 1942, M-129 00107

Leg Prosthesis, United States, ca. 1942, M-129 00111

Leg Prosthesis, United States, ca. 1945, M-129 11188

Leg Prosthesis, United States, ca. 1890, M-129 00037

Beauport's Artificial Leg, United Kingdom, ca. 1880, M-129 00013

G. W. Yerger Leg Prosthesis, United States, ca. 1850, M-129 00001

Miracle Type H-1 Mechanical Hand, United States, ca. 1945, M-129 11149

A.P.R.L. Sierra 4C Artificial Hand, United States, ca. 1955, M-129 11155

[Field Dressing], Iraqi Army, Operation Desert Storm, M-660 10423

Gauze, U.S. Army, World War II, M-660 48205

First Aid Packet For Shell Wounds, U.S. Army, World War I, M-660 54101

[Field Dressing], Imperial Japanese Navy, World War II, M-660 51801

[Field Dressing], Imperial Japanese Army, World War II, M-660 51808

[Gauze], German Armed Forces, World War II, M-660 51813

Quikclot Adsorbent Haemostatic Agent, U.S. Army, Global War on Terrorism, M-660 10984

Field Dressing, Individual Troop Bandages 4 x 7, U.S. Army, Operation Desert Storm, M-660 10709

Absorbent Sterilized Cotton, Imperial Russian Army, Russo-Japanese War, M-660 00519

Carlisle Model Large Battle Dressing, U.S. Army, World War II, M-660 00405

Carlisle Model Bandage With Sulfanilamide, U.S. Army, World War II, M-660 10973

Bandage Emergency Package, National Liberation Front (Viet Cong), Vietnam War, M-660 47102

Forehead Bandage Emergency Package, National Liberation Front (Viet Cong), Vietnam War, M-660 47103

Absorbent Pledget, National Liberation Front (Viet Cong), Vietnam War, M-660 00503

Esmarch Bandage, Iraqi Army, ca. 1991, M-660 10424

Esmarch Bandage, St. Andrew's Ambulance Association, ca. 1870, M-660 00532

* Photographs included in this catalogue

EXHIBIT CREDITS

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Back Cover. The Purple Heart is a combat decoration. The citation states that it is “for wounds received in action.” It is awarded to surviving members of the armed forces of the United States who are wounded by an instrument of war in the hands of the enemy. It is also awarded posthumously to the next of kin in the name of those who are killed in action or die of wounds received in action. The Purple Heart, originally created as the Badge of Military Merit by General George Washington, is the oldest military decoration still in use. Figure legend: Adapted from <http://www.purpleheart.org>. Accessed 20 November 2003.



“FOR WOUNDS RECEIVED IN ACTION”